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VIEWS, NEWS AND INTERVIEWS.

What is more thrilling, exhilarating and enjoyable than skimming over the ice on a pair of sharp skates, while the mellow moonlight casts its beams upon the glowing countenance of the one whose hand is clasped in yours and whose muff prevents the rest of the people from judging of the tightness of the clasp? The moon is not always with us, but the other details, granted the ice, should be easy to arrange. Why not substitute for the moon an electric search-light with a reflector which will gently diffuse its light in semblance of the moon?

The British steamship "Clement" recently arrived in New York from South American and West Indian ports with a cargo of 658 tons of rubber, the largest cargo of its kind that ever left the Amazon for this port. It is valued at $1,000,000.

An electric *café* is a thing apart. The electric *café* was a species of buffet that grew up in Paris, wherefrom the novice on tendering his coin received a considerable shock, says London *Lightning*. If, as was mostly the case, he remarked on the fact to the bystanders, he was told either that his funny-bone was at fault, or that he had been "electrified" by the charms of the barmaid. The annoying part to the victim was that no one else appeared to suffer. Then he went away, and to "prevent the place from hurting," as Mark Twain says, returned with another man to play the same game on. This time he found that he himself enjoyed immunity, while his friend fell into the trap. Then, in the course of conversation, the barmaid would explain that she worked the miracle on new-comers with her foot, for the sake of amusing her customers. The *cafés électriques* became highly popular, but were suppressed by the government, who feared that the joke might be carried too far.

One of the favorite experiments at the schools is to set the students to measure the varying powers of the arc in different directions, which they generally manage to do, according to the London *Electrical Engineer*, if they do not learn how to design a dynamo. Now this pleasure will be denied them, at any rate, if they use the globes of M. Frédureau, who has used the calculations once for all, and designed a globe of such a form and with prisms of such thickness that the light is distributed everywhere with evenness. The same idea is applicable to the bulbs of incandescent lamps, so that sideways or endways the filament shall give the same illuminating power. This may be advantageous in many circumstances, though, naturally, the cost of the globes is higher.

An ocean cable will probably be wanted very soon to connect the islands of Guanaja and Bonacca with the mainland of the coast of Honduras. This results from the fact that the charter of the Louisiana State Lottery Company expires on January 1, 1894, and its operations have been so restricted during the past few years that it is hunting around for a new home. Arrangements have been made with and a charter has been granted by the government of the Republic of Honduras, whereby the company will remove its business to one of the islands named above on the expiration of its present charter.

"One of my pleasantest experiences in Switzerland," said a traveled person, "was a ride I took on an electric car from Vevay to Chillon, along the margin of beautiful Lake Geneva. The car was a double-decker, and I, of course, rode on top. The scenery along the electric railway line is surpassingly grand. The sky is an intense blue, the mountains are bluer than the sky, and the lake is bluer than the mountains. The enjoyment of all this was greatly increased by the smooth running of the electric car, and by the fact that my seat on the upper deck gave an uninterrupted view in all directions."

The late Werner Von Siemens, the great German electrician, who was an ardent Liberal, was greatly surprised, says the Boston *Traveller*, when he read in the papers one morning shortly after the death of Emperor William that Emperor Frederick had raised him to the ranks of the hereditary nobility. He turned to Mme. Von Siemens, who was sitting in the room, and said: "Dear wife, now go at once to Lepke (the Berlin dealer in paintings) and buy ancestors." He cared little for the nobiliary particle before his name.

Telephone vs. Electric Railway.

The judgment of the Court of Appeals was made the judgment of the Supreme Court on January 10, in the case of the Hudson River Telephone Company *vs.* the Watervliet Turnpike and Railroad Company. The judgment is for the railroad company and, including $500 extra allowance, for $2,279.10 costs and disbursements. There is also $170 costs in an additional collateral matter.

Electrical Workers Adjust Labor Troubles.

The trouble existing between the National Brotherhood of Electrical Workers and the Electrical Contractors' Association, of this city, previous to the recent long strike on the part of workers, has at last been settled. An agreement was signed on January 19, between the union and the association, and ratified at a meeting of the union. The agreement is to go into effect on February 1. It provides that nine hours shall constitute a day's work, at $3 a day, and the agreement to remain in effect for one year. The association is to employ none but union workmen, and union workmen will work for none but members of the association. No sympathetic strikes or lockouts are to be undertaken.

The Last Horse Car in Toledo.

It may not be apparent to the careless observer that Manager Albion E. Lang, of Toledo, is possessed of sentiment and poetry in a high degree. But such is the case. His poetic nature finds a channel in deeds rather than words, as the following incident will show, says the *Street Railway Review*.

Eleven or twelve years ago, Mr. Lang purchased of its original owners a strip of strap rail and a few dilapidated cars, known as the Dorr street line.

After years of patient labor, the Toledo Consolidated has been brought to its present perfection, and the last line to come into the fold of electric traction was the Dorr street line. On the last day of 1892, however, Mr. Lang was notified that the line was finished, and Mr. Lang indulged the sentiment above referred to. So, equipped as a motorman, the manager ran the first car over the line, amid the cheers of the citizens and the waving of handkerchiefs.

Upon his return to the office, Mr. Lang thought of more sentiment and put it into execution. Therefore, the old horse car was run onto the tracks, and Mr. Lang as driver took the reins of the midnight car, and while 1892 flitted away, and the dreary midnight bells tolled the death of the old year, the last horse of the last horse line made its farewell appearance in Toledo.

Fig. 1.—Details of Stanley Transformer Fuse Box.

New Features of the Stanley Transformers.

IMPROVEMENTS IN A VALUABLE DEVICE.

Henry Hine, General Manager, Stanley Electric Manufacturing Company.

The Stanley Electric Manufacturing Company, of Pittsfield, Mass., have recently made improvements in the well known Stanley transformers, which include a method of insulation which gives a practically moisture-proof coil, and improvements in the form of the case, allowing very perfect ventilation.

Wm. Stanley, Jr., Electrician, Stanley Electric Manufacturing Company.

This company became known in the electrical field on April 1, 1891, through its advertisements and a pamphlet describing its transformer. The efficient staff of the company, which includes Charles Atwater, president and treasurer, Henry Hine, general manager, John H. Kelman, superintendent, and Wm. Stanley, Jr., electrician, then announced that the policy of the company would be to produce a thoroughly good article at a fair price. The company has just announced a change of the greatest importance, because it goes to the very basis of the essential feature in a transformer, namely, insulation. The commercial introduction of this new transformer has been delayed for the purpose of making absolute tests of the change and the entire reliability of the transformer itself and the methods adopted for its manufacture. The two absolute essentials in a transformer are safety and reliability, and on the method of insulation employed these two features depend.

The new method of insulation employed in the construction of Stanley transformers is that the coils form a perfectly solid mass, the wires being embedded in and surrounded by a substance of very high insulating properties. A cross-section of a coil of one of these transformers has the appearance of a first-class submarine cable, and the coil is claimed to be perfectly moisture-proof; in fact, it is said that these coils can be submerged in water indefinitely without injury to their insulation. The primary and secondary coils form a perfectly solid mass, and are protected from any possible contact with the iron core by a new and very ingenious method. The Stanley Company is so well satisfied as to the entire reliability of this new transformer that for five per cent. additional to the regular price they will insure the transformers for five years. In other words, the depreciation account on transformers bought on this plan cannot exceed one per cent. per annum for five years.

In designing its transformer, the Stanley Electric Manufacturing Company has endeavored to put itself in the position of a lighting company, in order that it might produce a device safe and convenient for practical use, as well as one with first class

electrical qualities. Every transformer sent out from their shops must pass most severe tests and come up to a predetermined standard before it can leave the factory. These tests are made to determine efficiency, regulation and the insulating resistance of all parts of the transformer. Besides this, the transformer is run for a long time on more than its full rated capacity, and afterwards is subjected to several times the electromotive force at which it is to be used in practice, in order that the company and not the customer may discover any weak spot in the transformer, if there be any.

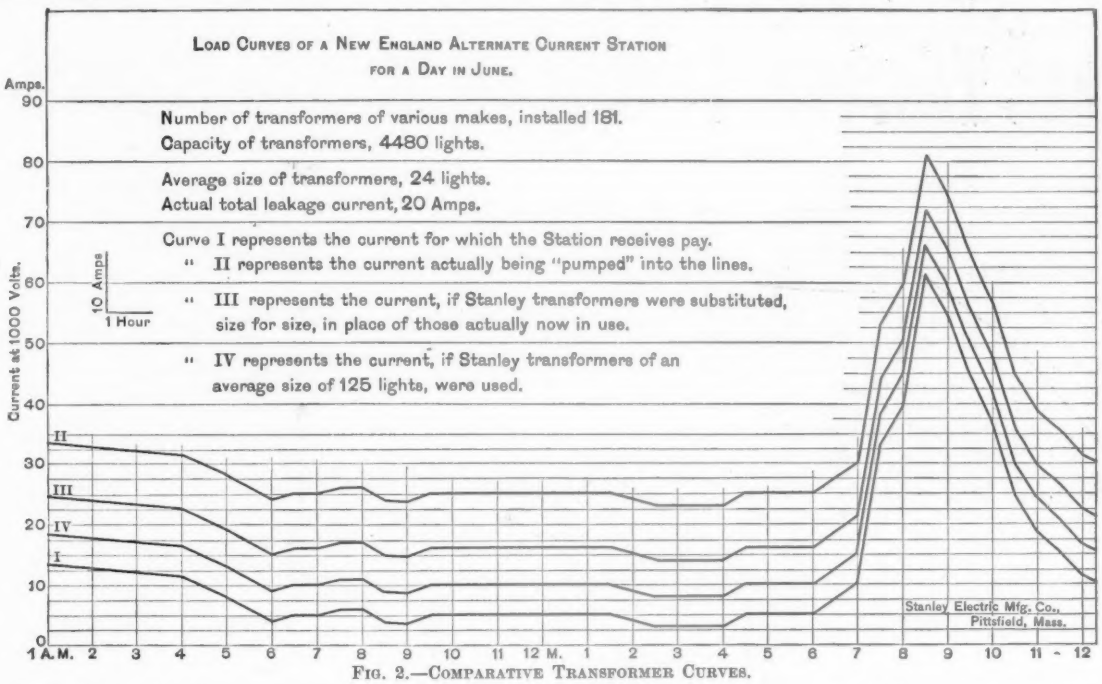
Load Curves of a New England Alternate Current Station
for a Day in June.
Amps.
Number of transformers of various makes, installed 181.
Capacity of transformers, 4480 lights.
Average size of transformers, 24 lights.
Actual total leakage current, 20 Amps.
Curve I represents the current for which the Station receives pay.
" II represents the current actually being "pumped" into the lines.
" III represents the current, if Stanley transformers were substituted, size for size, in place of those actually now in use.
" IV represents the current, if Stanley transformers of an average size of 125 lights, were used.
10 Amps
1 Hour
Current at 1000 Volts.
Stanley Electric Mfg. Co.,
Pittsfield, Mass.
1 A.M. 2 3 4 5 6 7 8 9 10 11 12 M. 1 2 3 4 5 6 7 8 9 10 11 12

Fig. 2.—Comparative Transformer Curves.

As for efficiency, the Stanley Company make claims as follows, depending on the size of the transformer: Full load, 97½ to 98 per cent.; half load, 97 1/10 to 90 per cent.; quarter load, 96 to 85 per cent. The variation of the secondary electromotive force between no load and full load is from one to one and a half volts out of 50, depending on the size. The large transformers are, of course, more efficient.

Lighting companies are in business for the sake of making money, but there is no doubt that in many plants to-day profits are being wasted by losses which might be avoided by purchasing the best instead of the cheapest transformers at the start, and which can be largely overcome as the station grows, by supplanting the cheap by the good, and large ones for small ones. The diagram, Fig. 2, gives a graphic illustration of this point. This diagram is based on an operating plant furnishing about 5,000 sixteen candle-power lights. The horizontal divisions represent amperes, and the vertical divisions represent hours of the day. The line marked I shows the actual current for which the station is receiving pay at different hours in the day. The line marked II shows the actual current which the station is sending out on the line at the corresponding time. The station in question has various makes of transformers in use and many of these are small. It will be seen that there is at all hours of the day a heavy loss. Should this station substitute Stanley transformers of the present make, size for size, throughout, instead of what they now have in use, the current sent out on the line would be represented by line III instead of line II. The average size of the transformers in the station now is 24 lights. If the manager would go one step farther and rearrange his transformer plant on the basis of 125 lights, the actual current sent out would be represented by the line IV, and a still greater saving could be accomplished by using larger transformers.

In the matter of safety, the insulation of the new Stanley transformer is claimed to possess several times the resisting power to high discharges of that commonly used. The insulating medium employed is a preparation specially developed for this use. The method of winding the coils also renders the chance of a cross between the primary or secondary, either from electrical or mechanical causes, extremely remote. Special tools are used in winding these coils, and the method of manufacture insures the most perfect workmanship.

The ease with which this transformer can be put in place should be an important consideration in the eyes of station managers. All that is required is to hoist it up by the eye bolts and hook it over the cross arm or timber on the side of the building. The ends of the supporting hooks are sharpened so that they sink into the wood, and the transformer then supports its own weight and can be easily and safely secured.

Fig. 1, shows the details of the fuse box used on the Stanley transformer. Only the primary circuit is fused, secondary fuses in the transformer itself being now regarded as unnecessary. The fuse is double pole, each wire or link being carried on a separate porcelain plug. To replace the fuse the door is dropped down by loosening one thumb-screw, the plug is pulled out and a new one is inserted, or a new fuse wire attached to the same plug. The same size plug is used in all sizes of transformers, and all plugs are interchangeable, there being no rights or lefts. The operation of changing a fuse requires but a few minutes, and is absolutely safe, as the plug is held in the hand entirely away from the transformer or circuit. No tools of any kind are required.

The Stanley Electric Manufacturing Company is an earnest advocate of large transformers. The saving in power obtained by their use is illustrated in the diagram, Fig. 3. The vertical divisions show the different sizes of transformers, and the horizontal divisions the units of current or power. The relative economy of the different sizes is at once apparent. It will be seen that a 20 lighter is twice as wasteful as a 75 lighter, and a 75 lighter is twice as wasteful as a 350 lighter. This diagram, taken in connection with the diagram shown in Fig. 2, should furnish food for thought for any station manager. The Stanley Company by no means advocates the use of large transformers to the total exclusion of small ones, but believes that a proper combination of the two will produce the best results. The Stanley transformers are made in sizes from 10 lights or 500 watts to 500 lights or 25,000 watts.

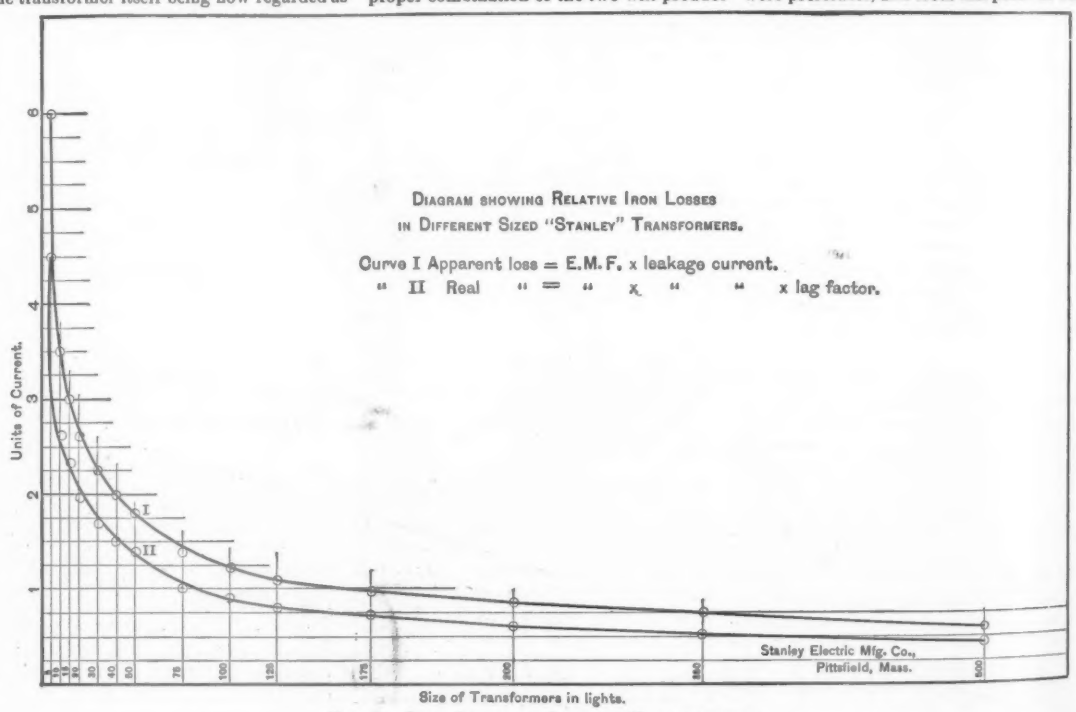
Diagram showing Relative Iron Losses
in Different Sized "Stanley" Transformers.
Curve I Apparent loss = E.M.F. x leakage current.
" II Real " = " x " " x lag factor.
Units of Current.
Size of Transformers in lights.
Stanley Electric Mfg. Co.,
Pittsfield, Mass.

Fig. 3.—Iron Losses in Stanley Transformers.

With this article will be found miniature portraits of Mr. Henry Hine, the progressive and efficient general manager of the Stanley Electric Manufacturing Company, and Mr. William Stanley, Jr., the well known electrical inventor, who has developed the transformers just described, in addition to doing much other work of value.

Historical Sketch of the Storage Battery.

ABSTRACT OF A PAPER READ BEFORE THE CIVIL ENGINEERS' CLUB, OF CLEVELAND, BY C. F. UBERLACHER.

In order to be able to form an idea of the patents and points at issue, we will begin with an explanation of a simple storage battery. I cannot do better here than to give Judge Coxe's definition, laid down by him in the suit of the Electrical Accumulator Company *vs.* the Julien Company. "A secondary battery is one which gives no electricity of itself, but is active only when rendered so by a current from an independent source."

The first commercial form of storage battery was invented by a Frenchman, Plante. The patents of Faure, Brush, Julien and most of the others are simple improvements upon this type, using practically the same materials and differing in the mode of construction.

There are several other types of storage battery but none of them have obtained much commercial prominence. The best known of these is probably the alkaline storage battery, using one zinc and one porous copper plate in a solution of caustic potash. There are several patents on this type, principally those of Reynier in France, and Desmazure, Entz and Phillips in this country. You will notice that this battery falls without Judge Coxe's definition, as it would furnish current before being charged from an external source. The charging simply regenerates it, or restores zinc to the zinc plate and oxygen to the porous copper. It is a storage battery but not a secondary battery.

Faure, 1878, in France, conceived the idea of dispensing with the long and expensive forming process of Plante by applying a layer of oxide of lead to the lead plates instead of producing it upon them by electrolyte action. In the summer and fall of 1878 he made a few experiments in this line, and, running across some difficulties, gave it up. In Faure's first experiments in 1878 he held his layer of oxide upon sheet lead plate by wrapping felt around both. This was also the idea with which he started in early in 1880, but he soon abandoned it for a grid somewhat similar to those now in use.

In 1879, Brush patented his "gas battery arc lamp," using a form of storage battery which has never become of commercial value, and then, hearing of Plante's work, began experiments in the same line. The first idea was to improve upon Plante's battery, and he began the work with rolled lead plates. He soon, however, discovered the cast plates were preferable, and from this point he went on to get a soft, spongy lead plate formed by chemical means, his first idea being to force a chloride of lead into the grid, and then lay one of these plates in dilute sulphuric acid with a sheet of zinc with a metallic connection between them, to allow the electrolyte current generated to reduce the chloride until it left only a spongy mass of lead. The idea then occurred to him of applying the active material direct to the plates by a coating of minium or litharge on sheets of lead, supporting it by blotting paper.

His next arrangement was a rolled lead

plate deeply grooved by gang saws, and in these grooves he forced the oxide. His first practical battery, one which he used for lighting his house early in the 80's, was, however, of the Plante type, the plates being cast in moulds which gave them the same form as the sawed plates, and then being formed by the regular Plante method of charging and discharging.

In the meantime, Faure, in France, had again begun experimenting in 1880, and had, in 1881, applied for a patent in the United States, with which Brush came into interference. Some of Brush's patents were granted immediately, but the principal one was put in interference with Faure and three others. This interference was hotly contested for four years, but Brush was, finally, in 1886, granted the broad patent substantially according to his original claims, and Faure's patent made subservient to his.

FIG. 4.—250 LIGHT STANLEY TRANSFORMER.

The principal claims in Brush's patent were the combination of the active material and a supporting grid, and the mechanical application of the active material to the plate or grid.

Faure's patent was made to cover the application of the active matter to the plate in the form of a paste, paint or cement (a very important item, by the way, as it is exceedingly difficult to make a successful plate by applying this active matter dry).

Julien's patents began in 1886. They are for an alloy of lead, antimony and mercury for the grid, also the form of the grid and various parts of the process of manufacture.

In addition to these there are other inventors without number who hold patents of more or less value. Swan and Sellon, of England, had patents on the form of the grid, which have figured in the suits, also on the alloy of lead and antimony. Gibson, of New York, holds valuable patents on the method of construction, as do Knowles, Pumpelly and a score of others.

The types of storage batteries are as numerous as the inventors. Reynier classifies them under four heads, viz., A, those having two lead plates and sulphuric acid diluted as an electrolyte; B, those having plates of lead oxide for the positive and copper for the negative, and sulphate of copper for the electrolyte; C, those having lead positive and zinc negative plates and sulphate of zinc for the electrolyte; D, those having porous copper for the positive, iron for the negative and sodium or potassium zincate for the electrolyte.

Of these the first type is by far the most numerous, as lead seems to be the metal easiest oxidized and handled, and is practically insoluble in the dilute sulphuric acid. No end of ingenuity has been expended in the formation of grids or plates for these batteries. As before mentioned, Plante's original idea was a small rolled lead plate, upon which he formed oxide by continually charging and discharging. This operation occupied from four to six months before the battery was in commercial shape. Faure's original plate has already been described.

The great difficulty found by the inventors of this lead battery has been the expansion and contraction of the active material as it became oxidized and deoxidized. Swan and Sellon, in England, were probably the earliest inventors attempting to correct this by the formation of the grid. Their principal idea was to divide up the mass of active material into such small quantities that their contraction and expansion would not loosen them from their hold upon the supporting plate.

After them have followed a host of other inventors with the same idea in view. Faure's first scheme was a small square hole, then followed Swan and Sellon with a hole smaller in the center than at the two surface openings. Gibson, of New York, made capsules of his active material and inserted these in holes in his supporting plate, afterward passing the plates through a pair of rollers and so burring, with seats on each side and a gangway down to the center, the ends of the holes over upon the active material. Another scheme was to put the active material in the form of pencils in a grooved plate and then bend the edges of the groove down upon these pencils of lead oxide. Still another was to fill a perforated lead tube with active material, and afterward bend this into the form of a plate. Inventors following Plante tried also schemes of every description to make a plate of finely divided lead. One idea was to take lead wool, or spun lead, and tie it in bunches with lead wires. Brush's moulded and sawed plates come also under this head. A Denver inventor made a combination of lead, zinc and silver, from which he cut out the zinc by a chemical means. The Woodward people, of Detroit, cast lead and salt together, afterward dissolving out the salt, and so getting a porous plate.

Probably the neatest scheme for this was a modification of Brush's chloride idea. Under this method the chloride was fused and cast into small double convex discs; these were then cast into the lead plate and reduced by the same method as employed by Brush.

Eickemeyer, of Yonkers, placed side by side plates of insulating material and cast lead with corresponding holes drilled straight through from one end of his cell to the other. The holes in the lead cast plates were recessed and the active material forced into these recesses.

The Ford & Washburn battery, of which you have all probably recently heard, belongs under this head. It has a very ingenious device for doing away with the trouble caused by expansion and contraction, and consequent loosening of the active matter. It consists of a thin porous earthenware cup, inside of which is placed a hollow lead plate, allowing a space between the plate and cup; outside also is placed a perforated lead cup, allowing some space between it and the earthenware cup. The space thus left inside and outside is filled with the active material which forms the two plates of the battery. The hollow lead plate inside is supposed to allow for the contraction and expansion of the active material. It can readily be seen that short circuiting cannot take place in this battery unless the earthenware cup should break. This is probably the latest attempt to produce a battery suitable for street railway work, and it is sincerely to be hoped that it will be successful.

Of Reynier's class *B* there are few specimens, and none of them have reached commercial account. They are practically primary batteries which are regenerated after becoming exhausted.

The same can be said of class *C*, those having a lead positive and zinc negative plate with sulphate of zinc as an electrolyte. The principal trouble with this battery has been that it loses its charge when standing on open circuit.

Class *D* has been exploited by several Frenchmen, principal among whom is Desmazure. His battery consisted of a porous copper positive plate produced by moulding granulated copper under an enormous hydraulic pressure and covered with parchment, and tinned iron wire gauze negative. The electrolyte was potassium zincate. The oxide of copper formed would dissolve quite readily in the electrolyte, but did not dyolize to any appreciable extent. This was the battery used on the famous torpedo boat, "Gymnote," in the harbor at Havre.

Waddell, Entz and Phillips have introduced a very similar battery in this country for street railway work. Its advantage is that it is considerably lighter than lead batteries having the same storage capacity, but it is liable to lose its charge on open circuit due to the formation of what is technically known as "zinc trees" on the iron plate.

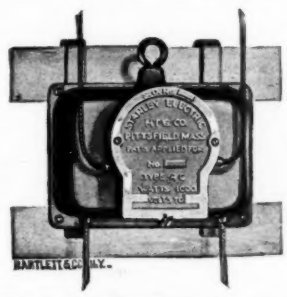

FIG. 5.—TWENTY LIGHT STANLEY TRANSFORMER.

Having given a partial review of the different forms of batteries which have been put upon the market, I will now proceed to treat some of the difficulties which lie in the way. I have already mentioned the expansion and contraction of the active matter in the lead batteries, and the consequent loosening from the grids or plates. Plante ran up against this trouble very early and attempted to get around it by making his plates smaller, but even with small plates he frequently found that when the porous lead or oxide coating reached any depth at all it would crack and fall away from the solid lead entirely.

In my personal experience, however, the battery which gave the best satisfaction was the old Plante type, with plates about 12x14 inches. This ran along for six or eight years with no more attention than an occasional refilling.

Swan and Sellon's idea of dividing up the active material on the plate has also been mentioned. With all the ingenuity that has been expended upon the supporting grid, it has been found that the active material forces itself out, the force in some cases seeming to be almost of an explosive nature and producing radial cracks on the active material. The plates of the battery are all placed close together in order to reduce, as far as possible, the ohmic resistance, so that this disintegration, or loosening of the flakes makes a contact from one plate to the next, so short circuiting two of the series, and occasioning rapid deterioration of the whole cell. The ohmic resistance of the electrolyte is another source of loss, and this is probably the only one which can never be obviated. It is, however, of very small account, as it in no way injures the life of the battery. Another trouble caused by the expansion and contraction of the active material is the so called buckling of the plates, expansion taking place unequally on the two sides, causing the lead grid to bow out and so come in contact with the next one in the cell. What is technically termed sulphate (?) is usually the occasion of this. This sulphating is the forming in a battery when left uncharged, or even if left standing in any condition without use for any length of time, of a white sulphate of lead, which is practically insoluble in the dilute sulphuric acid, and it is at the same time a very good insulator, so that portions of the active matter becoming covered with it become inactive.

This on charging and discharging increases the ohmic resistance of the battery and at the same time decreases its capacity in proportion, also occasioning the injurious buckling.

Lead is at the present time the only material which experimenters have been able to oxidize and deoxidize successfully. It can readily be seen that this necessitates a heavy weight for the battery, as lead is one of the most easily oxidized of all the metals, and so requires a large weight of material to store a given amount of energy. Lead grids have also been used almost exclusively for the support of this active material. This again brings in the element of weight as does also the use of fluid electrolyte.

Storage batteries are also liable to the trouble of local action. Local action takes place between two portions of the same plate whose chemical conditions are different, and produces the same effect on the rest of the plate as though the battery were partially short circuited.

(To be continued.)

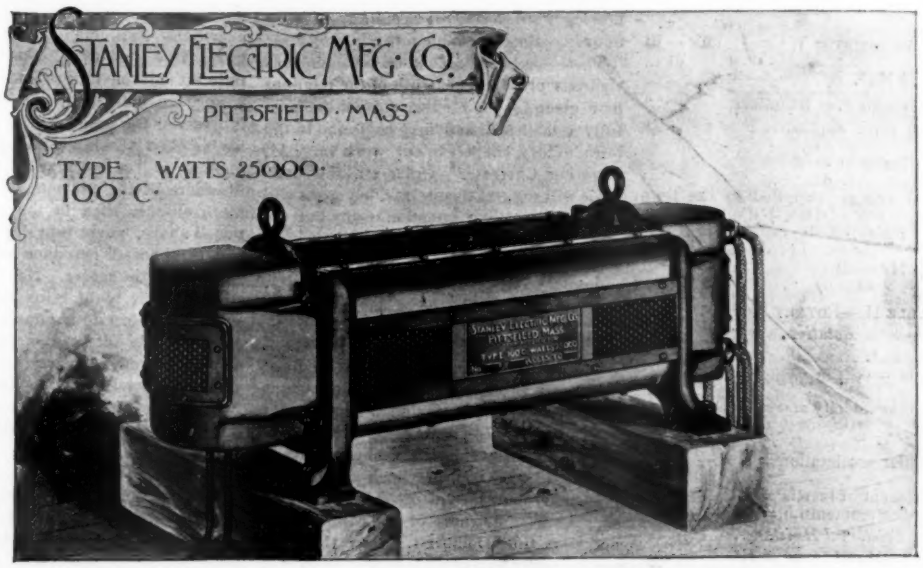

FIG. 6.—500 LIGHT STANLEY TRANSFORMER.

The Railway Equipment Company.

The annual meeting of the stockholders of the Railway Equipment Company, of Chicago, was held on Tuesday, 17th inst. and the report of General Manager W. R. Mason showed a most satisfactory state of affairs. The business of the company has been very greatly in excess of expectations and is daily increasing. The late devices brought out by the company have had an unprecedented sale, and are being adopted throughout the entire country. Mr. Mason called attention to the need of further increasing the manufacturing facilities. We understand that a prominent capitalist has become interested in the company with the intention of still further increasing its business.

Some Mechanical and Electrical Analogies.

BY DR. F. BEDELL AND DR. A. C. CREHORE.

No phenomena are so readily comprehended as those which may be compared directly with facts that are familiar, and no reasoning is so quickly grasped as reasoning "by analogy." The analogies between certain mechanical and electrical relations are so striking, that when either relations are understood the others follow, and from the laws of mechanics we can readily write those of electricity. The process is a reversible one, and the electrician can, with equal ease, step over into the realms of dynamics. To enable one to reason accurately in this manner and to reach definite results with absolute certainty, it is necessary to give, with exactness, the fundamental relations of mechanics and electricity. The following tables are, therefore, given showing the analogies between linear motion, motion of rotation and the electric current. Starting a current of electricity in a circuit is analogous to imparting motion to a body and requires an impressed force. This force must overcome the resistance (electrical resistance corresponding to that of friction) and the inertia of the mass or current.

In the case of the electrical current, this inertia is called "self-induction." A revolving fly-wheel may well represent the flow of electricity, its velocity corresponding to the current, its moment of inertia to the coefficient of self-induction, and the friction to ohmic resistance.

TABLE I.—LINEAR MOTION.

Notation.

1. Time = t.
2. Distance = S.
3. Linear velocity = $v = \frac{ds}{dt}$ $\quad ds = vdt.$
4. Linear acceleration = $a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$
5. Mass = M.
6. Momentum = Mv.

Frictional Resistance.

7. Frictional resistance = R.
8. Force to overcome resistance = $F_R = Rv.$
9. Energy expended in overcoming resistance in the time $dt = dW_R = F_R ds = Rv^2dt.$

Inertia.

10. Force to overcome inertia = $F^1 = Ma = M\frac{dv}{dt}$
11. Kinetic energy acquired in the time $dt = dW^1 = F^1ds = Mv\frac{dv}{dt}dt.$
12. Kinetic energy = $W^1 = \int_o^v Mv\frac{dv}{dt}dt = \frac{1}{2}Mv^2.$

Inertia Plus Resistance.

13. Total force applied = $F = F_R + F^1 = Rv + M\frac{dv}{dt}$
14. Total energy supplied in the time $dt = dW = dW_R + dW^1$; or, $Fds = F_R ds + F^1ds$; or, $Fvdt = Rv^2dt + Mv\frac{dv}{dt}dt.$

TABLE II.—ROTARY MOTION.

Notation.

1. Time = t.
2. Angle = ϕ.
3. Angular velocity = $\omega = \frac{d\phi}{dt}$ $\quad d\phi = \omega dt$
4. Angular acceleration = $a = \frac{d\omega}{dt} = \frac{d^2\phi}{dt^2}$
5. Movement of inertia = I.
6. Angular momentum = $I\omega$.

Frictional Resistance.

7. Frictional resistance = R.
8. Torque to overcome resistance = $T_R = R\omega.$
9. Energy expended in over-coming resistance in the time $dt = dW_R = T_R d\phi = R\omega^2dt.$

Inertia.

10. Torque to overcome inertia = $T^1 = Ia = I\frac{d\omega}{dt}$
11. Kinetic energy acquired in the time $dt = dW^1 = T^1d\phi = I\omega\frac{d\omega}{dt}dt.$
12. Kinetic energy = $W^1 = \int_o^\omega I\omega\frac{d\omega}{dt}dt = \frac{1}{2}I\omega^2.$

Inertia Plus Resistance.

13. Total torque applied = $T = T_R + T^1 = R\omega + I\frac{d\omega}{dt}$
14. Total energy supplied in the time $dt = dW = dW_R + dW^1$; or, $Td\phi = T_R d\phi + T^1d\phi$; or, $T\omega dt = R\omega^2dt + I\omega\frac{d\omega}{dt}dt.$

TABLE III.—ELECTRIC CURRENT.

Notation

1. Time = t.
2. Quantity = q.
3. Current = $i = \frac{dq}{dt}$ $\quad dq = idt.$
4. Current acceleration = $\beta = \frac{di}{dt}$
5. Coefficient of self-induction = L.
6. Electro-magnetic momentum = Li.

Ohmic Resistance.

7. Ohmic resistance = R.
8. Electromotive force to overcome resistance = $e_R = Ri.$
9. Energy expended in overcoming resistance in the time $dt = dW_R = e_R dq = Ri^2dt.$

Self-Induction.

10. Electro motive force to overcome self-induction = $e^1 = L\beta = L\frac{di}{dt}$
11. Energy acquired by the magnetic field in the time $dt = dW^1 = e^1dq = Li\frac{di}{dt}dt.$
12. Energy of magnetic field = $W^1 = \int_o^i Li\frac{di}{dt}dt = \frac{1}{2}Li^2.$

Resistance Plus Self-Induction.

13. Total electromotive force applied = $e = e_R + e^1 = Ri + L\frac{di}{dt}$
14. Total energy supplied in the time $dt = dW = dW_R + dW^1$; or, $edq = e_R dq + e^1dq$; or, $eidt = Ri^2dt + Li\frac{di}{dt}dt.$

A study of the tables will make these analogies more clear. It is to be noted that the fly-wheel or moving mass, in slowing down, gives back its kinetic energy and the wheel is carried on, after the impressed force is removed, until this is entirely consumed in over-coming friction. Similarly, when the current diminishes upon the removal of the impressed electromotive force, the energy stored in the magnetic field is restored to the circuit and the current keeps flowing until the energy is entirely used up in overcoming the ohmic resistance.

These analogies cannot be considered as rigorous proof. The truth of the relations here given for the electric current has been fully established, and may be found in the introductory chapter to our work on "Alternating Currents." Other striking analogies will suggest themselves, but space will not permit calling attention to any but the most fudamental ones given above.

Physical Laboratory,
January 16, 1893. Cornell University.

Dewey Electric Heating Company.

The annual meeting of the stockholders of the Dewey Electric Heating Company was held in Syracuse, N. Y., on January 9, for the purpose of electing directors. The Dewey Electric Heating Company has a capital of $200,000, of which $50,000 are preferred shares and $150,000 common shares. The business of the company did not start until October 1. Since that time the company has equipped over 40 electric street railways with electric heaters, besides having a very large sale of electric heaters for offices and dwellings. The following officers were elected for the ensuing year: E. Laas, president; Jacob Knapp, vice-president; Chas. H. Duell, treasurer; Mark W. Dewey, secretary and electrician; E. B. Wyman, general manager. Directors, E. Laas, C. H. Duell, Thomas Meacham, E. B. Wyman, John J. Laas, Jacob Knapp, M. W. Dewey.

Electricity in Medicine.

(From the New York Sun.)

The enormous strides made by the new force in commerce and industries of late years have been to a certain extent paralleled by the application of electricity in medicine and surgery. The electric motor turns the drill of the dentist, bores out all the noses of mankind in the hands of the rhinologist, and may run the saw and the trephine of the surgeon. The electric light is made to illuminate all the cavities and interiors of the human body, so that "the pestilence that walketh in darkness" in the black recesses of our viscera is sought out and driven away by the electric searchlight. It is nothing now to put an endoscope into the stomach and scrutinize its walls from one end to the other, and in a dark room the very size of the stomach is determined by the translumination of the abdominal walls when a light is turned on inside of that viscus.

Electricity furnishes heat for the cautery with which morbid surfaces may be healed, wounds stimulated, and tumors extirpated.

The electrolytic needle removes the hairs of the bearded woman, eradicates birth-marks, decomposes tumors, coagulates aneurisms, and in its most romantic rôle manufactures those most desired ornaments of the feminine physiognomy, lovely dimples.

The electromagnet pulls out the beam from our neighbor's eye, when the beam is in the shape of a piece of iron, and when the operation is intelligently directed by the ophthalmologist, it may hunt up and draw out wandering needles.

One of the new features of electric medication is the introduction of drugs into the human body through the skin. This is done by placing solutions of any drug upon a sponge, which is made the positive pole, and placed against the skin. When the current is turned on, the drug is actually driven through the skin into the tissues. The application is not at all painful. Thus cocaine has been driven in over a painful nerve, and neuralgias have been relieved by it. Many other drugs have been used in this way. This property of electricity is known as cataphoresis. Operations have been performed after anæsthetizing the skin and subjacent tissues cataphoretically.

The neuralogist, perhaps, finds a large therapeutic field for electrical exploration. With the continuous current he soothes the pains of peripheral nerves, calms down an excited brain, stimulates healthy processes in a diseased spinal cord, exercises paralyzed muscles, rejuvenates overworked limbs, and aids in the rebuilding of tissues in members that have wasted away. Sometimes he calls in to his aid the interrupted and the alternating currents, and, occasionally, takes into service the static sparks evolved from his big glass wheels and Leyden jars. The method of the working of electricity in disorders of the nervous system is much more obscure than in the maladies mentioned above, where heat, light, electrolysis and cataphoresis produce effects at once apparent to the senses. Not able to demonstrate objectively the value of electricity in some of the chronic nervous diseases, a great deal has to be accepted on faith. There is dispute in some quarters as to its intrinsic value here, and many incline to the idea that suggestion has a good deal to do with improvement in patients of this kind treated in this way.

Besides its employment as a therapeutic agent, electricity has considerable value as a means of diagnosis in many neurological conditions. For instance, the resistance as measured by the rheostat is reduced in exophthalmic goitre and increased in hysteria. The muscular contractions produced in paralysis from injury to certain parts of the nervous system are so different from contractions produced by electricity in paralysis due to lesions in the brain, as an example, that their differentiation constitutes an important aid in distinguishing these affections one from another. Then, too, in the surgery of the brain and spinal cord, which has newly sprung into existence, electric stimulation of parts of the brain and of nerve roots is very valuable in localizing the exact region to be operated upon. Indeed, much of our knowledge of the localization of functions in different parts of the surface of the brain is owing to electricity made use of by physiologists in their marvellous experimental researches in cerebral domains.

Altogether electricity occupies an extensive place in the armamentarium of the physician. All parts of the human economy are explored by its beneficent light, and there is no cell so secretly hidden that it may not be influenced by this wonderful force, which may be made to penetrate skin, muscle, bone, blood, nerves and viscera. No one can yet place a limit upon its possibilities as a remedial agent, for each year new apparatus, new devices, new forms of current, and new methods are made available to the medical profession in its noble warfare against the diseases which assail mankind on every hand. It is not in vain that men have sometimes looked heavenward for aid in sore affliction, for has not the lightning been drawn from the clouds to become his friend and heaven-born ally?

An Electric Torpedo Detector.

An important demonstration has just been made in England of the possibilities of an ingenious electrical and telephonic apparatus for defending roadsteads, anchorages and mine fields by giving warning by visible and audible signals on shore of the approach at night or during thick weather of torpedo boats or other hostile vessels. The experiments in connection with the invention, which is credited to an American, Captain McEvoy, the torpedo and submarine expert, formerly attached to the Confederate army, have extended over several weeks, and have been supervised by a representative of the War Department and a committee of the royal engineers. The instrument employed is called a "hydrophone," and consists of two parts. One part is placed at the bottom of the water, outside the anchorage or mine field, at a depth of from five to fifteen fathoms, and the other is fixed at a station on shore, and the two are electrically connected by cable at distances of from one to five miles. In the demonstration referred to, the instrument was sunk in seven fathoms and about 300 yards from the shore.

The submerged part consists of a bell-shaped iron case, three-fourths of an inch thick, 20 inches in height and extreme diameter, and weighing about 340 pounds. At the top is fitted a sensitive vibrator or diaphragm enclosed in a copper box. It is formed of a plate of ebonite with carbon attachments, and when the case is submerged the delicate mechanism is kept clear of the water by means of the column of compressed air, which is enclosed, as in a diving-bell. As a torpedo boat approaches within a radius of half a mile, or a man-of-war within a mile, the pulsations of the propeller produce a vibratory motion inside the case. These vibrations are transmitted to the station on shore in the following manner: The electric current from the land battery passes through the vibrating mechanism, and also through the apparatus on shore, in the circuit of which is placed an instrument called a kinesicope, which is somewhat of the nature of a galvanometer.

By means of this the movements in the water are communicated to a needle flickering in a graduated arc, and when the oscillations become pronounced the needle is clutched by a magnet at the end of the arc. This makes contact, and the vibrations in the submerged case are made visible and audible by means of flashing light, the firing of a gun and the ringing of a bell. Telephonic signals are also transmitted through the same current. For coast defenses a number of hydrophones could be sunk in the approaches to a port or dockyard, and warning would thus be given of the neighborhood of an enemy; but, besides this, it is proposed to make the hydrophone useful in dangerous zones, around headlands that are frequently fatal to shipping in dense fogs. A danger zone could be connected by means of the hydrophone with the nearest coast-guard station; and a ship would be warned of the danger into which it was running by the automatic firing of a gun or the flashing of a light.

The Development of High-Speed Automatic Cut-off Engines.

BY THE COURTESY OF THE BALL & WOOD CO.

High-speed automatic cut-off engines have been known commercially for 12 or 15 years. Their era may be said to date roughly from the Philadelphia Exposition, where the type first arrested public attention, and where the more familiar style of slow-speed engine marked the decline of its supremacy in a display, which, after all, was mere bigness, brilliant and spectacular. For the moment the colossus filled the eye, but then and there began the conflict which has seen it worsted and which has each year resulted in a greater adoption of high-speed as the principle that must be the basis of all advances and improvements in steam engine work.

The "swan song" of the slow-speed engine was thus heard in 1876, little as it may have had that meaning even to those who thought themselves quick to catch the significance of things. Looking back now it is easy to perceive that "high-speed" was destined to win its way very quickly. This advance in the steam engine art was a sympathetic response to the onward movement in the mechanic arts as a whole. Industries of every kind had attained a higher stage of development, and they all wanted a motive power of corresponding superiority. Inventiveness had branched out in many new directions, producing machinery more intricate and subtle than had ever been seen before, and it depended for the full accomplishment of its purpose on a driving power more responsive, more sensitive, more accurate and more flexible than had sufficed for a primitive age.

Just then, too, the electric light burst upon the vision, and while it seemed easy to run some of the arc dynamos with any kind of an engine, it was soon found that the dynamo for incandescent lighting, its armature revolving many hundred times a minute, demanded, with an urgency that would not be quelled, an engine of high rotative speed and closest regulation. Perhaps there has never been witnessed a more striking instance of two mechanisms advancing hand in hand than this of the modern dynamo and the modern high-speed engine. At first the dynamo builders, who quickly reached a standard in their work, grasped eagerly at the engines available, and took them rather from necessity than from choice. The popular notion was that such engines were unreliable and short lived, and, as usually happens, there were not wanting terrible examples at which to point the finger of scorn. But in a very short time, so swift was the improvement and so great was the enthusiasm with which young and progressive engineers of the present generation threw themselves on the problems presented, the high-speed engine become a really marvelous piece of ingenious and efficient machinery; until to day it has measured itself against every difficulty and conquered them all. Even of some of the pioneer forms, it deserves to be said that they have run on for years with almost no repairs, with unappreciable wear, and in view of their remote origin, with a very fair approximation to the superb finish and regulation seen in the approved and accepted types now dominant.

At the beginning engineers, whether in factories or electric light stations, were a little bit afraid of their high-speed engines, and it was held a mark of prudence and sound judgment to put in reserve power, for fear something or other—nobody knew exactly what—might occur and lead to trouble. To-day, however, while the plan of power sub-division on the score of economy and flexibility has been largely adopted, the old notion of "reserve" has disappeared. The man who worries himself now is he who has all his power plant tied up in one big slow-speed unit. The first high-speed engines for lighting were small, and matched in size the dynamos they were attached to. But with the enormous development of the electrical industries of light and power, larger dynamos came on the scene, with larger central stations and larger engine units; but in the transition, emboldened by the emphatic success of the smaller sizes, the station managers still wanted high-speed engines, until at last the latter were put to a duty that brought them into the most direct competition with the slow-speed engine in a domain that had been regarded as peculiarly its own. The curious error had prevailed that larger powers were reserved in some mysterious manner for slow-speed, and that "slow and sure" was the only adage applicable. Engineers who reasoned on this line forgot that in railroad work the heaviest locomotives were the fastest; that in navigation each big, new ocean greyhound was faster than its predecessor in proportion to its size, and that sureness had come to be synonymous with high-speed, and slow-speed synonymous with general inefficiency.

The comparisons made between the two systems of high and slow speed engines may be briefly reviewed. On the side of the high-speed engine was, and is, claimed less cost and less floor space per horse-power; better regulation; more flexibility of plant by reason of smaller units; smaller expense of a duplicate unit to meet emergencies, constituting a natural "reserve" available any moment for casual loads as against an artificial reserve so big as to be an outrageous expense or so insignificant as to be worse than useless. The advocates of the large slow-speed engines urged, on the other side, claims as to less cost of fuel per horse-power, less cost of repairs, and less cost of attendance. Part of this contention, it must be remembered, however, was true only in the earlier stages of the evolution, when the slow-speed engine was already a perfected type, while the high-speed builders had still much to learn and all their record to make. It can now be fairly asserted that in all the essential elements of economy, the "curve" of the high speed engine of to-day has become a much better one than that of its former serious rival, whose old claims must, therefore, be greatly modified and in part abandoned.

Any one point in the argument may be examined to determine the merits of the issue. Suppose we take, for example, the governor—that of the Ball & Wood engine—with its provision for a lifetime of wear; and then the same make of valve with its promise of an almost endless service. Connecting these two, we note the simple rods and rock-arm transmission supported in pillow-blocks as complete in every detail as those carrying the main shaft. Against this exquisitely simple valve gear we have to place the complicated releasing gear of a slow-speed engine. The mere inspection of the two sets of mechanism is enough. But even if the cost of repairs were not clearly to be seen on the side of the simple high-speed form, then, for electrical and much other work with swiftly moving parts, the balance would at once be put to its credit on account of the cost of maintaining with slow-speed engines, line shafts, counter shafts, friction clutch pulleys and a whole array of intermediate power consumers and wasters. Shafting, pulleys, belts, etc., are better than ever, and yet, every now and then, owing partly to the inherent defects of the system and partly to bad engine practice, such reports of power wasted with slow-speed engines make their appearance that it is hard to conceive how the plant or mill can possibly be conducted at a profit.

The higher cost of attendance may still stand, perhaps, against the high-speed engine, chiefly because of the larger number of units, but it is not safe to judge by surface indications. The abnormal friction losses with slow-speed engines are often, undoubtedly, attributable to cheap, poor attendance. The high-speed engine attracts the better grade of ability, in the same way that an express train does. Moreover, offsetting the higher cost of attendance, as stated in dollars and cents, and without going any deeper, we may point once more to the immense economic advantage of having the smaller units all driven at their most efficient load under careful handling, and of being able to fall back on reserve units of lower first cost and small operative expense.

The repairs of the high-speed engine are from the very nature of the case generally small. They can, of course, also be infrequent. With an engine of the class illustrated in this pamphlet they will be both infrequent and minute. Of the repairs with a large slow-speed engine, it may be said that for a long time they will maintain a plausible minimum, and then an accident happens that should be classed with earthquakes. "Repairs" is scarcely the word needed for the occasion.

The slow-speed engine is, as everybody knows, capable, with its small clearance, of realizing a greater number of expansions of steam than the single valve engine; consequently it develops power more economically, the difference in its favor being about as 27 is to 30, these figures representing the respective water consumption of each type of engine per horse power per hour, under normal, ordinary conditions.

But these figures assume both engines to be economically loaded. In practical work, such for instance as electric lighting, the inability to load a Corliss engine economically all the time has the inevitable tendency to make it much more wasteful of steam than smaller engines suitably loaded. The contrast is very sharp between a central station with one or two big engines loaded only for two or three hours in the evening after a wasteful light load all the rest of the day, and another station of well planned units, every one of which comes into play at the instant required and has barely started before it buckles down to a full, highly economical load which it carries right through the run. Better practice than that there cannot be.

INTERIOR VIEW OF THE ENGINE SHOPS OF THE BALL & WOOD COMPANY, ELIZABETH, N. J.

The accompanying illustration shows an interior view of the Ball & Wood Company's splendidly appointed shops at Elizabeth, N. J. This plant is provided with the most recent appliances for successful manufacture, and all Ball & Wood engines are made from entirely new patterns, in which the company has aimed to give its patrons the benefit of what has been learned in the engine business up to the present time. All parts of the improved Ball & Wood engine are fitted to standard gauges, and are kept in stock to promptly meet demands for repairs.

The Chicago-St. Louis Electric Railroad Seeks Exemption from Import Duties.

A press dispatch from Washington states that certain persons interested in the projected electric railroad between Chicago and St. Louis appeared before the Senate Committee on Commerce recently, and endeavored to show cause why the Government should permit them to import necessary construction material free of duty, in consideration of building a pioneer line which shall carry passengers and mail to and from Chicago and St. Louis at a speed of over a hundred miles an hour. Dr. Wellington Adams, the projector of the road, John Muir, general superintendent of the company, and Representative Seth Cobb, of St. Louis, represented the interests of the company, while the General Electric Company was represented by Eugene H. Lewis, of New York, as counsel.

Dr. Adams said that he had executed a contract for the construction of the road, and had placed about half of the stock. He said that by reason of the hostility of the General Electric Company to his scheme, it was doubtful if the necessary electric machinery could be built in this country in time for the World's Fair.

Mr. Lewis, in behalf of the General Electric Company, said that his company could and did manufacture electrical goods as well and as cheaply as any concern in any other country, in proof of which he asserted that they were supplying the plant for 18 electric roads building in Europe. He questioned the honesty of purpose of the Chicago and St. Louis Company, which, he said, never intended to really build a railroad. The committee took the bill under consideration.

Fire in Peoria.

The power station of the Central Railroad Company, at Peoria, Ill., was destroyed by fire on January 17. The loss, which is complete, amounts to $104,000, with an insurance of $90,000.

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The Philadelphia *Inquirer* stepped on a barrel hoop when it cried down the extension of the trolley system in Philadelphia, and said "the trolley is the cheapest known system of street car propulsion." Time was when the trolley carried the burden of being "expensive and dangerous." Now it's "cheap" and will soon be "safe."

The State of Massachusetts, as viewed from a balloon, will soon present the appearance of a huge gridiron, if all the trolley schemes now in contemplation are carried out. Hamlets will be connected by rapid transit with villages, villages with towns, and towns with cities, until a business man living in the interior of the State can take his family to the seaside for an airing *via* the trolley cars. Sleeping cars will have no place in the rolling stock equipment of electric railways, because a man can travel by trolley by day, by George, and sleep by night in a village hotel, by Jove.

There is something sad, is there not, in the fact that the latest issue of the *Western Electrician* contains an illustrated article exploiting the handsome quarters of the Chicago Electric Club, and in another place in the same issue announces the application of the New York Electric Club for a receiver?

The New York *Times* thus accounts for the dissolution of the New York Electric Club:

"The collapse of the Electric Club marks another wreck on the strand of trades or professional unions under the guise of purely social organizations. It is almost an impossibility to make a social club from the ranks of one profession, unless there is something more in the scope than the mere gathering together in the evening of people of one class. Men wish to avoid 'talking shop' for at least a few hours in the day, and to go from business to dinner to be surrounded by the atmosphere of the office is certainly anything but a relaxation."

Our opinion of the matter is that the Electric Club was organized to accomplish an object, namely, to bring about pleasant personal relations between electrical people who did not "speak as they passed by" in 1885. That object has been accomplished, the purpose of the club has been fulfilled, and now, like an old pair of boots, it is cast aside. There is certainly room and need for an electric club in New York city run on proper principles.

Some very interesting mechanical and electrical analogies are contributed to this issue of the ELECTRICAL REVIEW by Drs. Bedell and Crehore, of the Cornell University Physical Laboratory. The analogies between electrical and mechanical relations are becoming better understood and the present contribution is a step in progress.

The business of raising large horses in Canada for export to street railway companies in the States has nearly disappeared since the extended introduction of the trolley system. The change has reduced the price of these horses in Canada about one-half, and many breeders and dealers have retired from business. Thus do we progress.

It looks now that, if New York is to have rapid transit facilities, it will be by way of an extension of the elevated railway system. The tunnel scheme seems doomed, for the present, at least. If steam power is used on the extended lines, the present noise, dirt and steam will be greatly increased, and this, of course, will be most undesirable. Let the elevated railway management adopt electric propulsion on the extension lines, and gradually change over the whole system as fast as the present steam locomotive equipment wears out. A good example has been set by the elevated railways at Kansas City, Mo., which are now operated electrically. It will be found cheaper, more satisfactory to everybody and more efficient to use electric power on the elevated railways of New York city.

HIGH TENSION EXPERIMENTS BY TESLA AND OTHERS.

The experiments of Dr. Schoentjes, described by our correspondent on another page, in which some of the beautiful results achieved by Mr. Tesla with alternating currents of high tension are reproduced, will be examined with interest. Mr. Tesla used, it will be remembered, a specially constructed generator to produce his currents which were raised in tension by an induction coil and in frequency by a spark gap. Dr. Schoentjes, it is said, achieves the same results with a simple vibrator, battery and induction coil, it being possible to operate the vibrator at a rate as low as five beats per second and yet produce many of the results noted by Mr. Tesla. This is certainly going from the complex to the simple, the usual trend of scientific and industrial progress. The experiments are so easily made, that the accuracy of our correspondent's statements can be readily verified. The results he describes would seem to indicate that the phenomena produced by Mr. Tesla are not necessarily connected with extremely high tension or extremely high frequency, unless, indeed, some hitherto unknown vibrant quality resides in the spark gap, periodically produced in the operation of an ordinary buzzer.

There are peculiar features of ordinary high tension electricity yet to be recognized. Our attention was called a few days ago to a new phenomenon, which may be displayed with an ordinary incandescent lamp. If such a lamp be held in one hand and the bulb be struck a few rapid blows with the palm of the other hand, the lamp and filament will glow with a soft radiance sufficient to clearly outline the lamp in a dark room. The radiance continues only so long as the blows continue, which must be frequent and comparatively violent. The peculiar action is more readily awakened by some individuals than by others. Perhaps the dryness of the hands has much to do with it. It is probably a purely static phenomenon, but is interesting.

LETTERS FROM A LABORATORY.—XXXI.

BY JULIAN A. MOSES.

During the processes of manufacturing apparatus in the laboratory it is very often necessary to have reproductions of drawings for the workmen, and there is nothing so good or so cheap for this purpose as the well known blue print. This process is about the simplest and most convenient of the many in the science of photography, and may be conducted with little apparatus.

Blue print or "blue process" paper, as it is often called, may be purchased in almost any of the many draughtsman's supply stores, but I have found that it is seldom possible to obtain paper that is at all satisfactory. The paper is necessarily old, unless you are fortunate enough to procure it immediately after it is made, and is, therefore, unfit for the higher class of work necessary for uniformly excellent results.

Much better prints may be obtained if you manufacture the paper at the time when it is wanted; and as the process is not at all difficult, it is, therefore, advisable to utilize it. Not much time is necessary, and only a slightly darkened room is required for the process of coating the paper.

Numbers of solutions have been tried for the sensitizing, and each manufacturer claims to have the best. Sometimes the dealer gives his prepared paper some name by which it becomes known. In one case a brand of paper has acquired a reputation for the manufacturer. Still, I have never found one out of the many that would suit my purpose, and, as a matter of course, I have made my paper whenever I needed it.

The following are the solutions I have found best adapted to my wants for making the blue process paper.

SOLUTION I.

Water	1 fl. oz.
Red prussiate of potash	60 grains.

SOLUTION II.

Water	1 fl. oz.
Ammonia citrate of iron	70 grains.

Prepare these two solutions in separate bottles, which should be kept in the dark so that their contents may not decompose. Equal quantities of each should be mixed only just before using. Many makers of the paper declare that it makes no difference whether the liquids are mixed immediately, or a long time before using, but I have found that much better results may be obtained by the former method.

For coating the paper, a broad flat camel's hair brush should be dipped in the mixture, and the brush thus charged should be passed over the paper in even and regular strokes at right angles with each other. The best paper to use is that known as extra white wrapping paper, which is somewhat porous and not too glossy to shed the solution when it is first applied. Too much solution should not be put on the paper, for it is liable to form in ridges which, when dry, show in streaks in the print. If you are satisfied that the quantity on the brush has been so gauged that there will be no puddle of solution on the bottom of the sheet, hang it up by two spring clothes-pins, and allow it to dry spontaneously. If too rapid evaporation takes place, the paper will be left with an uneven surface which is not the best for printing purposes.

Print with a very densely lined drawing on transparent paper until a grayish metallic lustre is seen in the darkest parts. The time of printing is necessarily a variable quantity, for it depends on the intensity of the light. When printed, develop in cool water, and be careful to keep the prints away from the fumes of ammonia, which are liable to turn them white. To dry the blue prints, lay them while still wet upon a surface of clean glass, and permit the water to evaporate, away from any source of extra heat.

They may now be mounted upon any strong cardboard, using a good stiff starch paste as the adhering medium.

Where it is necessary to write upon the blue print after it has been mounted, some kind of ink must be used that will show a dense white upon the dark blue ground. Many manufacturers have made such inks and have generally charged good prices for them, but not many of them have been well suited for the purpose. One that will write perfectly white is made as follows: Make a saturated solution of caustic soda, and of this take one part, and of water take four parts. Mix them well, and with a clean steel pen dipped in the solution write whatever may be necessary, being careful not to have too much of the liquid on the nibs, for the paper being very porous is liable, by capillary action, to absorb too much of the caustic soda from the pen, and thus make a white blot upon the paper. It is best when the blue prints are finished and mounted, to varnish them with shellac varnish, as this protects them from water and dirt, and in a measure prevents the paper from curling away from the pasteboard.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Lynn and Boston Railroad Company inaugurated their electric car service on Saturday, January 14, the line being opened to the public and cars running regularly for the first time.

The Consolidated Electric Manufacturing Company, of this city, have just installed a complete plant of their apparatus in one of the large mills of Lawrence, Mass. Four of their new 60 light arc machines are now in operation there.

The Shipman Engine Company are reaping the benefits of an international reputation, having just sent one of their two horse-power engines and boiler to the west coast of South America. These are for use in an isolated electric light plant in that section.

Boston Capitalists are reaching out for suburban electric roads as good paying investments, and propose consolidating the lines in Lowell, Lawrence and Haverhill, Mass. The new syndicate is also interested in electric roads in Bangor, Me., New London and Norwich, Conn.

The Brown Electric Company, whose initial bow to the public was made with the opening of the new year, are making a strong bid for a share of the supply business in this section, and have already closed several good contracts. Their new quarters at the corner of Summer and Federal streets are rapidly filling up with a full line of electrical supplies, and they are now prepared to handle anything in the shape of business which may come along.

Much Has Been Said upon the subject of Insulac. Its waterproof and oil-proof qualities, its great resistance to electrical pressure and its adhesive qualities are now well known. The practical application of Insulac in the great quantities which have been used by leading companies has developed the fact that it differs from all other materials in that it is mechanically good. Instead of hardening down to a flint-like coating, to crack and scale off and grind into powder, it appears that, under the heat generated by the working of a machine, this compound softens very slightly until it resembles rawhide in its leathery and elastic condition. This fact is certainly of great interest to engineers, as it materially lengthens the life of coils and renders them less likely to burn out or become charred.

The Pettingell-Andrews Company have closed two very nice contracts recently, one for the entire construction and equipment of an electric railway about eight miles long, running from Bellows Falls, Vt., to Paxton Mills, and the other for a large amount of the well-known "O. K." feeder wire from the Rockland, Thomaston and Camden Street Railway Company, of Rockland, Me. They have also a remarkably handsome exhibit of the specialties of the Interior Conduit & Insulation Company, for whom they control the Eastern agency, in the shape of an ornamental cherry board, 6 x 9 feet, with an overhead canopy three feet wide, on which is displayed a complete line of junction boxes in iron and brass, switches, cut-outs, sockets, conduits of all shapes and sizes, tools and, in fact, everything used in connection with the highest class of concealed and exposed interior work. A very noticeable feature is the variety of conduits in different tints, to match any style of wall decoration, in the effect of which they would aid very materially. H. G. T.

Boston, January 21.

OUR CANADIAN LETTER.

Ottawa, Ont.—Letters patent of incorporation have been issued to the Ahearn Electric Heating and Manufacturing Company. Capital, $25,000. Headquarters at Ottawa.

St. Louis du Mile End, Que.—The town council has confirmed the contract entered into with Mr. A. J. Corriveau granting him the franchise for an electric railway and electric lighting in the municipality.

Montreal, Que.—The St. Henri Light and Power Company will apply to the legislature at its next session to increase the capital stock to $1,000,000, and otherwise to amend its charter.—Application will be made to obtain letters patent granting a charter to the Merchants' Electric and General Service Company. The object sought is to protect banks, warehouses, safes, offices and stores from burglary, by means of a system of electric burglar alarm; also to protect banks, warehouses, dwellings, stores and other property from fire by means of automatic fire alarm electrical apparatus; to establish a night watch and rated system for its patrons; to furnish messengers to persons requiring them; to operate call boxes or telephones, to take in and despatch telegraphs, and generally to act as light carriers and protectors of the property of its patrons in the province of Quebec. Capital, $30,000. Place of business, Montreal. The petitioners are Hon. A. W. Ogilvie, senator; S. H. Ewing, merchant; J. Cooper, merchant; G. S. Brush, founder; E. Hanson, broker; J. A. Cross, manager; S. Finley, bank director; G. A. Greene, merchant. J. A. C.

Montreal, January 16.

Space at the World's Fair.

On January 18, according to a press dispatch, Director-General Davis, of the World's Fair, prepared a statement showing that of 3,642,812 square feet of exhibit space in the World's Fair buildings, only 214,476 remain to be assigned. Col. Davis says it is necessary to hold a certain area in reserve for first-class exhibitors who want to come in at the last moment, rather than give it to inferior firms, simply because they get their applications in early. His statement shows that foreign countries have received 1,419,517 square feet of space and Americans 1,787,263. According to Col. Davis' statement, the total exhibit area of the Electricity Building is 185,100 feet; 60,952 feet have been assigned to foreign exhibitors and 137,072 have been assigned to American exhibitors. If these figures are correctly reported, it may be easily seen that 12,924 feet, or over seven per cent. more space than the total exhibit area of the Electricity Building, have been assigned for exhibition purposes. Thus it will be seen that another reduction in space all around may be in order, and the exhibits will probably be more cramped and unsatisfactory than before. Now, if the Worlds' Fair management can succeed in shutting up the Fair at seven o'clock every night, the electrical exhibit will be the flat failure which seems to be its destiny.

A Westinghouse Exhibit.

The Westinghouse Electric and Manufacturing Company during last week exhibited their new lamp and their World's Fair generators at the old Westinghouse air brake shops in Allegheny, Pa., where the generators are under construction. Attendants were present to explain things, and a considerable number of people took advantage of the opportunity to view the immense dynamos and inspect the much-talked of lamp.

There are 12 of the large generators, each having a maximum capacity of 15,000 sixteen candle-power lamps, and with the twelve 1,000 horse-power engines required to drive them will form the largest single exhibit of machinery ever shown at an exposition. The weight of each dynamo will be about 150,000 pounds and the armature, the largest single piece of each machine, is about 90 inches in diameter and weighs 42,000 pounds.

The old air brake shops have been entirely refitted for the construction of these machines. New tools and a powerful electric crane have been installed. A spur track from the Fort Wayne Railroad runs right into the shops, so that when the big generators have been placed on the cars they will not have to be touched until they arrive at their destination on the World's Fair grounds.

PERSONAL.

Capt. Eugene Griffin, of the General Electric Company, has been very ill with congestion of the brain and tonsilitis.

Mr. S. M. Hamill, secretary and general manager of the Brush Electric Company, has just returned from a southern trip.

Mr. Wm. H. McKinlock, president of the Central Electric Company, was a New York visitor last week, arriving in time to meet his wife and daughter, Adelaide, on their return from an extended visit in Europe.

President Cranston and Superintendent White, of the Providence Telephone Company, stopped over in New York Tuesday of last week to visit with electrical friends. Before returning to Providence they visited the Albany telephone exchange, inspecting the system and the new switchboard recently installed there, and described at length in the ELECTRICAL REVIEW of December 10, 1892. The Albany switchboard is attracting considerable attention from telephone people generally. Messrs. Bailey and Rhoades, the well known telephonists of western Pennsylvania, were visitors at Albany the day previous.

No Fire at Eagle Pass, Texas.

The report that the station of the Electric Light and Power Company, at Eagle Pass, Tex., had been destroyed by fire with a loss of $40,000, is incorrect. Mr. L. F. Doich, manager, writes that he has been receiving telegrams from all over the country offering to rebuild his station, and asks the REVIEW to correct the rumor. It was, evidently, some other Texas fire.

Tesla's Experiments Simplified.

TO THE EDITOR OF ELECTRICAL REVIEW:

Prof. M. Schoentjes, instructor of electrical engineering at the University of Gant, Belgium, has recently described an extremely simple arrangement of circuits and apparatus, by means of which all of Mr. Tesla's experiments may be repeated.

It will be remembered that Tesla charges a condenser through secondary currents developed in the primary of a Ruhmkorff coil, and then causes the oscillatory discharge from a spark between two terminals to pass through the primary circuit of a second induction coil immersed in oil. The currents set up in the secondary coil surrounding the submersed primary are used for the Tesla experiments.

Professor Schoentjes has succeeded in doing away with the above described complicated arrangement, and employs merely one induction coil connected with a vibrator. The coil is 40 by 20 centimetres, and the energizing current furnishes a number of accumulators.

With this simple arrangement he produces the following phenomena:

(*a*) Both ends of the secondary remain open. 1. A Geissler tube, with or without electrodes, glows if held in the hand of the experimenter or placed upon a block of paraffine at a distance of 30 to 40 centimetres from the coil. 2. The same result is obtained if the tube is held by the experimenter, with one end touching one of the terminals of the secondary; a contact is not required. 3. The same phenomenon is observed when the tube is placed on a block of paraffine, touching with one of its ends one terminal of the secondary coil.

(*b*) Leave one of the terminals of the secondary open and attach the other to a sheet of iron suspended from the ceiling by a non-conductor. 1. Connecting the open terminal to a vacuum bulb, having one electrode and a rectilinear carbon filament, the latter glows. 2. A Crooke's tube prepared with phosphorescing powder glows when the experimenter holds it below the suspended sheet of iron. 3. The tube becomes luminous when placed on a block of paraffine below the iron sheet.

(*c*) The two terminals of the secondary are connected by a metallic conductor having a spark gap. A vacuum tube glows in the neighborhood of the coil.

Using the same arrangement as described under (*c*), but connecting one of the terminals to the metal sheet, we find that vacuum tubes glow if placed either directly under the metal sheet or near it. These experiments succeed at such a low rate of vibration as five oscillations per second and using a much smaller inductorium than the coil the dimensions of which we have described.

Boston, Mass., Jan. 20. V.

World's Fair News from Electrical Engineer Stieringer.

TO THE EDITOR OF ELECTRICAL REVIEW:

Reliable news regarding the progress of the plans for the World's Columbian Exposition is now of much importance to many electrical readers. The attempt of the *Electrical World*, of this week, to show in advance of the proper time of publication features which have not yet been decided upon regarding the proposed illuminated fountains, recalls a similar effort by the same paper, less than three years ago.

At that time I sent to the *Electrical World* for publication the following letter, which never appeared in its columns:

44 WALL ST., NEW YORK CITY, June 25, 1890.

Editor Electrical World.

I am greatly interested in the sketch in your issue of this week of the "Proposed Edison Light Tower at the Minneapolis Exposition," more especially because having the responsibility of designing and erecting this tower, I am still undecided as to nearly all the detail which your sketch purports to illustrate.

I congratulate you upon the vividness of the imagination of your artist, and only regret that his idea and my own should have happened to be entirely dissimilar, and that his picture of this feature of the coming Exposition fails entirely to give your readers an adequate conception of the magnitude and beauty of the proposed structure and its surroundings.

Both these unreliable batches of information came from the same source, the artist whose name appears on the illustrations. In the case of the Minneapolis tower, the disclosure was simply imaginative and premature; in the present case of the Chicago fountains, it is both imaginative and inaccurate, and also a breach of faith. I presume it will be characterized as "newspaper enterprise"—the sort of enterprise that when it cannot print a genuine interview prints an imaginary one.

I believe it was the celebrated A. Ward who once said, "I had rather no nothing at all than to no what ain't so."

(Signed) L. STIERINGER,
Consulting Electrical Engineer, World's Fair.
Chicago, January 20, 1893.

Important Meeting of the Advisory Council of the Chicago Electrical Congress.

A meeting of the Advisory Council of the Chicago World's Congress of Electricians was held at the rooms of the American Institute of Electrical Engineers, New York, on January 17.

The following gentlemen were present: Dr. Elisha Gray, chairman; Prof. Wm. A. Anthony, Prof. Chas. R. Cross, Dr. Louis Duncan, Dr. Wm. Geyer, Mr. Carl Hering, Mr. Geo. A. Hamilton, Prof. F. B. Crocker, Mr. A. E. Kennelly, Mr. T. D. Lockwood, Mr. T. C. Martin, Mr. Geo. M. Phelps, Dr. M. I. Pupin, Mr. R. W. Pope, Prof. H. A. Rowland, Mr. Herbert Laws Webb.

Mr. H. L. Webb was elected secretary of the meeting, in the absence of Professor Carhart, permanent secretary of the council. The preliminary reports of the English and American committees, already made public, were received.

It was resolved that the Electrical Congress of 1893 shall consist of two chambers, of which the legislative chamber shall decide on units, names of units and standards, and shall consist solely of delegates named by their respective governments.

A committee was appointed to determine the total number of official delegates and their apportionment to the various countries to be represented.

The following apportionment of delegates was made by the committee whose report was adopted by the meeting: Great Britain 5, France 5, Germany 5, Austro-Hungary 5, United States 5, Belgium 3, Italy 3, Switzerland 3, Holland 2, Denmark 2, Norway and Sweden 2, Russia 2, Spain 2, Portugal 1, British North America 1, Australian Colonies 1, India 1, Japan 1, China 1, Mexico 1, Brazil 1, Chili 1, Peru 1, Argentine Republic 1; making a total of 55 official delegates.

It was resolved that a Committee on Invitations be appointed by the chairman, this committee to consist of five members, who shall select and recommend to the chairman the names of electricians, electrical engineers and others who shall be members of the Electrical Congress. Said committee to co-operate with the foreign committees.

It was further resolved that in addition to invitations to deliberating and voting members of the Congress, a general intimation shall be extended through the journals or otherwise that the meetings will be open to the public, for attending the proceedings, but not for taking part therein.

It was resolved that a Committee on Programme and Papers be appointed by the chairman. This committee shall consist of eight members, whose duty it shall be to invite, receive and consider papers and other documents relating to the work to be done by the congress. And it was further resolved that it shall be the duty of the committee to formulate a programme for the congress.

In was resolved that the reports of the English and American sub committees, which were received at the meeting, should be referred to the Committee on Programme and Papers, and that the committee confer with the English committee as fully as possible and with such other foreign committees as may be formed.

It was resolved that the Electrical Congress of 1893 shall last one week, beginning on August 21.

It was resolved that a Committee of Three be appointed by the chairman as a Finance Committee.

It was resolved that an Executive Committee of five shall be appointed by the chairman, said committee to have full power to act for the advisory council.

It was resolved that the question of charging a fee for membership of the congress, and fixing the amount of such fee, be referred to the Executive Committee.

Electrical Forging of Round Shapes.

THE ELECTRICAL FORGING COMPANY, OF BOSTON, PRODUCES A MACHINE FOR THIS WORK.

Round shapes have puzzled metal workers through all past ages. It has been generally conceded that the usual method of forging an approximate shape and then turning to accurate size on a lathe are tedious and expensive ways of doing the work. For nearly one hundred years the attempt to make round forgings by rolling processes has been going on, but with indifferent success. A history of the attempts show many partial successes, but in every case some vital principle has been omitted, or some mistake made which has prevented ultimate success.

The accompanying cut shows the Electrical Forging Company's latest improved No. 3 patent rolling machine for manufacturing rolled forging. This machine was designed and built for rapid and accurate work; being rotary in all its movements, no time or power is lost in the return of the dies to their working position. The machine may be worked at any speed, from slow to fast, according to the nature of the work required, it is quickly and easily adjusted and automatic in all parts, and for from one half inch up to six inches long, and from one-half to one inch in diameter is turned out by this size machine. These machines are built in sizes ranging from 0 for the smallest work up to No. 10 for the largest and heaviest kind of work.

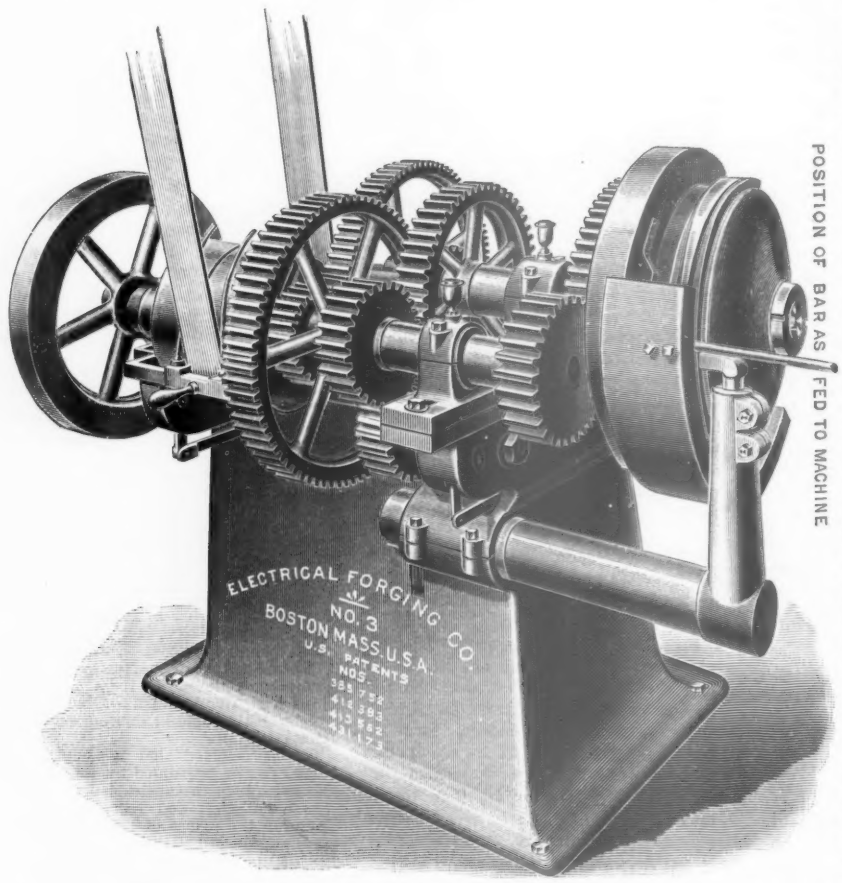


FIG. 1.—ELECTRICAL FORGING COMPANY'S IMPROVED MACHINE FOR FORGING ROUND SHAPES.

The uses to which they can be put are many and varied, as a great variety of things now produced are made of iron or steel of low carbon in order that they may be turned out economically. By this process highly carbonized steel may be worked equally as well as iron or soft steel; this insures increased strength, an advantage of the first importance in all kinds of work. It is within the range of these machines to roll successfully steel of the highest grade of crucible down to the open hearth and Bessemer. Copper and brass are also successfully worked. It is claimed that these machines stand alone in the matter of producing rolled forgings of irregular shape without leaving them hollow or piped. Articles rolled on this machine, whether of regular or irregular shape, are perfectly solid.

Steel handles of all sizes and shapes heretofore invariably made on the turning lathe may now be produced by the electrical rolling process at a saving of 99 per cent. of the required labor, it being possible to roll 100 perfect handles in the time required to make one by former methods. Also in making handles a considerable saving is effected, in that there is practically no waste of metal.

Anti-friction steel balls from one-eighth up to two inches in diameter are made by the electrical rolled forging process at a speed unapproached by other methods. The work done by this process is perfectly accurate and the operation quick. A red hot steel bar is inserted between the revolving dies (the position of the steel bar is shown in the cut of the machine), and for every revolution of the dies a ball is forged, or a conical shot, a chair screw, a bolt with thread and head complete, a boiler rivet, tiny calks for lumbermen's shoes, or a spindle or taper pin may be produced. One hundred millions of anti-friction steel balls are now required to supply the trade in the United States alone, and from 8,000,000 to 10,000,000 of boot calks. The custom heretofore has been to forge these calks with a trip hammer, and the manufacturer has been unable to make over 4,000 per day, generally not over 2,000, while with this improved rolling machine 30,000 a day may be made at a cost far below the price at which they have been heretofore produced.

The other cuts show a few of the many samples of work made on this improved rolling machine. Fig. 2 is an electrically heated and rolled forged steel ball; Fig. 3, a rolled forged machine handle made in several shapes and sizes; Fig. 4, rolled forged hexagon head bolt, head and thread made at one operation, square and round headed bolts made by the same dies complete at one operation; Fig. 5, shoe calk, made in four sizes; Fig. 6, conical shell; Fig. 7, shuttle tip; Figs. 8 and 9, hinge tips; Fig. 10, hames start, made in several sizes; Fig. 11, right and left hand thread, made at one operation; Fig. 12, rolled steel cane and umbrella tips; Fig. 13, rolled bicycle spindles, all sizes; Figs. 14 and 15, rolled castor pins.

Mr. Lyon's Lecture on Long Distance Telephony.

On the evening of January 20 the large assembly hall of the Young Men's Christian Association, in Brooklyn, was filled with an interested audience desirous of learning something about the history of long distance telephony and the apparatus employed in accomplishing the wonderful results. Mr. Edward H. Lyon, of the Metropolitan Telephone and Telegraph Company, N. Y., was to deliver a lecture upon this subject. Mr. Lyon presented a highly entertaining discourse, which held his audience spellbound in attention from the start to the finish. He said much, of course, that is familiar to the electrical public, and has already been explained to the readers of the ELECTRICAL REVIEW, but the matter was genuine news to the large body of the audience before whom the address was made. The lecture was illustrated by a large number of superb lantern slides, which were thrown upon a large screen, and the lecturer first educated his audience as to the development of the telephone and its various stages of improvement, to its present refined condition, and then carried them progressively from the hall in which they were assembled, which was equipped with hand telephones scattered throughout the hall within reach of the audience, through the streets of Brooklyn to the central office of the New York and New Jersey Telephone Company, thence over the Brooklyn Bridge to the central office of the Metropolitan Telephone and Telegraph Company, in New York, thence to the cable station at the edge of North River, thence across North River to the Jersey side, thence to the central office of the long distance company in Chicago, the various stages of this path of travel being copiously illustrated by admirable photographic views of the modes of supporting the telephone wires, the central office equipments, including switchboards, distributing boards, cables, operators' room, and all the other interesting paraphernalia involved in telephonic transmission. At the close of the lecture the connection between Brooklyn and Chicago was made, after some delay created by the enterprise of a newspaper man who had possession of the wire, and the audience were treated to a cornet solo brought over the wire from far distant Chicago. The notes of the "Star Spangled Banner" were clearly heard by the entire audience, and as quaintly remarked by the president of the electrical section of the Brooklyn Institute, this was the first time within the history of the world that sound was transmitted electrically *so far* and heard simultaneously by so great a number of people. Conversation was then carried on between Mr. Lyon, the lecturer, and individuals in Chicago, and the members of the audience listened at the hand 'phones already referred to and enjoyed the novel experience of hearing conversation spoken at a distance of over 1,000 miles. It was a treat to see the delighted expression on the faces of the fortunate individuals who got possession of the receivers. The evening's entertainment was generally recognized with loud applause as both delightful and instructive, and the lecturer retired covered with glory.

At the end of 1891 there were 64 telephone exchanges and 23 trunk lines in operation in Austria.

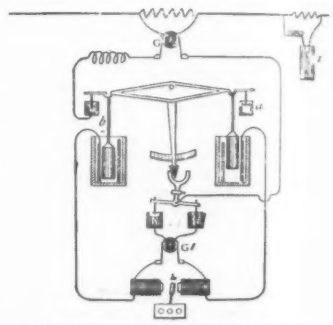
The district managers of the National Telephone Company, of England, have taken concerted action to get the telephone introduced as a domestic luxury.

Electrical Recording Meters.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, JANUARY 17, 1893, BY CARYL D. HASKINS.

It was my first intention to present this paper on "Electrical Recording Meters" or "Electricity Meters" in the form of a strictly technical monograph, dealing with each of the more prominent theories of meter construction separately and fully. Upon outlining this plan it at once became evident that to do so I should be obliged to devote some four or five hundred pages of closely written manuscript to my subject matter, and should have been obliged to deliver the final three-quarters of my paper during the early morning hours succeeding the session. I therefore changed my plan, and now propose to briefly describe and discuss the leading elements which, singly or combined, have gone to make up the typical meters presented to the public up to the present time. I find myself limited to generalities and the mathematical theory, and strictly technical considerations have necessarily been neglected that the field might be approximately covered.

A brief history of the evolution of the electric meter would be very appropriate, but repetition is odious, and I beg to refer all who are interested in the early history and genealogy of the meter to that most interesting and complete paper on this subject read before the Institute by Mr. George W. Walker, May 21, 1891.



ELECTRICAL RECORDING METERS.

The earliest meter patent was granted in 1872 to Mr. S. Gardner, of New York city, and the principle of a magnetic or electromagnetic release for a simple clock movement is preserved in two or three so-called time counters to-day, and is doubtless very useful for many purposes; as for example in the Spaudling clock for registering the hours of use of a motor, or other similar devices for registering the hour of use of arc circuits. These devices I shall neglect; they are not meters within the true sense of the word, and their simplicity is obvious.

Before undertaking any description, a few words may be appropriately devoted to the question of the unit by which it is most desirable to measure electrical power in use.

The ampere has been, perhaps, to-day, the popular unit for the measurement of electricity supplied; yet, on careful consideration, how very meaningless for work of this kind is the ampere unit. It would only find a parallel in the very ingenious early settler of Maryland, who bought six linear miles of land from the trusting Indians.

Had we but one standard voltage in use for lighting and for power, and for other purposes, no unit could be better than the ampere-hour for meter measurement; but unfortunately, or fortunately, as the case may be, there is scarcely a potential between 5 and 2,000 volts which does not more or less imperatively call for measurement by meter to-day, and if the ampere unit is to be retained, then it will become necessary to reconcile ourselves to the use of an endless number of constants, or to a still more endless schedule of ampere-hour rates.

We wish to measure power delivered; in fact, we wish to know how much coal a group of lamps is consuming. This points directly to the watt, and I venture to assert

that careful consideration will invariably show that the watt is the only true unit for the measurement of electricity by meter. Unless, perchance, we adopt the cubic foot, as has at least one central station in the United States, a very amusing but equally practical demonstration of American ingenuity.

The earliest successful meters, if we consider classes rather than individual instruments, were the chemical meters, closely followed by thermo-meters.

The chemical meter is obviously capable of giving most accurate results; in fact, with proper manipulation, it is very doubtful whether any measuring device which has up to to-day been designed could more correctly sum up passing power. It is in the manipulation and care which such meters require that their fault lies, if fault there be.

It will be useless for me to waste the time and patience of my kind listeners by describing to them the eminently successful and generally popular Edison chemical meter, and I will not attempt to do so.

An electroplating bath in its meter form as generally used does not, however, give a dial indication, and the consumers ask for a dial indication almost invariably, unless they have already become thoroughly familiarized with Edison meters as used by many large Edison stations.

Many very ingenious and some quite successful attempts have been made to actuate a train of gears by the electro-deposition of an electrolytic bath. Thus we have two electrodes suspended at the opposite ends of a walking-beam, as shown in Fig. 1. This walking-beam is in various ways connected with a pole-changer, and, as but a small portion of the current being measured passes through the true meter (for, of course, almost all chemical meters are shunted), the pole-changer is not perhaps a very serious objection.

The action of such a meter as this is obvious; we have a deposit from one electrode onto the other, until the second electrode becomes the heavier, when the beam tips and the recording device is set one notch ahead, the pole-changer is thrown over and the deposit takes place in an opposite direction, the former plus electrode becoming the minus, and so on. This device deposits and reposits the same zinc, or rather electrode material. Again, we have a modification of the same device in the form of a wheel bearing a number of electrodes, and on the same principle setting up continuous rotation.

It should be noted, that in this first digression from the chemical meter, we at once meet with the prime factor of difficulty in all motor meter construction—that of friction, which, if uncompensated, must invariably introduce more or less serious error. We shall touch on this point more fully hereafter.

Another form of self-registering electrolytic meter has a cathode plate suspended from a spring-balance, an ordinary sensitive spring weighing machine, and the heavier the cathode grows, so much greater is the registration of the spring indicator. This device is perhaps preferable to the reciprocating movement just described, but is limited in the capacity of the spring, and probably lacks sensitiveness to small amounts, being dependent, of course, solely upon the nicety of construction in the spring-balance.

Mercury has at times been employed in the construction of electrolytic meters, and with at least moderate success, for with a mercury anode, and a cathode of the same or other material, a record easily measured may be obtained, and such a meter may even be made self registering in a graduated tube or by half a dozen other more or less simple means. Such are the more typical electrolytic meters. There are other similar devices which have not been mentioned, for it is absolutely impossible to deal with everything within the brief limits of a single paper.

Another form of chemical meter, formerly quite popular among inventors, depended for its registration upon the decomposition of water, generally acidulated water, and sometimes upon the decomposition of more volatile substances. This class of meter may very properly be divided under two heads:

First, those meters simply dependent upon the measurement of the gas developed by the decomposition of water through any gas-registering device. In fact, we may say that such meters are mere decomposing baths connected to a gas meter. There are some devices of merit which may be classed under this head, but the principle is probably not commercial, for we have nothing very successful of this kind in use to-day.

One of the more ingenious meters of this kind provides a diagonally placed rotating wheel with pockets; the decomposition takes place directly under each pocket progressively, and, as the air pocket fills with gas, the wheel rotates sufficiently to free this gas at the surface of the fluid, bringing another pocket into place. Others have a rising and falling diaphragm, like the popular gas meter; and still others a delicately poised air fan over a minute aperture. This last device is obviously most inefficient.

(To be continued.)

FIGS. 2-14.—ROUNDED SHAPES MADE BY THE ELECTRICAL FORGING COMPANY'S IMPROVED MACHINE.

The Telephone Stole a Telegraph Message.

"I once received a telegraph message through a telephone, and a queer incident it was," said Jacob Ebersole, who is at the Laclede. "At that time I was assistant inspector at one of the police stations in Buffalo, N. Y. It was a stormy night out, and the office was all but deserted. I sat reading a newspaper for a little while, and then, to amuse myself, called up a neighboring inspector by telephone and began a desultory conversation. All at once the voice of my friend became indistinct and confused. I called to him to speak louder, but the only result was a low monotonous buzzing, and then I knew that the wire was crossed at some point. I was about to hang up the 'phone when I heard a few successive clicks much like that of a telegraph instrument. Being an operator myself, I listened for further signals. A telegraph operator from somewhere was tapping the key for attention. Then Buffalo was called. I began to get interested. I drew a piece of paper towards me and prepared to take the message. Buffalo gave an answering signal and then the message came. It was from Inspector Byrnes, of New York, and asked for the arrest of a criminal, supposed to arrive in Buffalo that night, answering a certain description. I referred the dispatch to my superior officer, who delegated men to watch the train. Forty-five minutes later a messenger brought the telegram to the office, identically the same as that I had written out. The peculiarity of the occurrence impressed itself deeply upon all those who happened to hear me relate it."—*St. Louis Globe Democrat.*

American Society of Civil Engineers.

The fortieth annual meeting of the American Society of Civil Engineers was held on January 18, in the Twenty-third Street Baptist Church, New York. The following officers were elected: President, William Metcalf, Pittsburgh; vice-presidents, Elmer L. Corthell, Chicago, and Charles Macdonald, New York; directors, to serve three years, William S. Pope, Detroit; Frederic P. Stearns, Minneapolis; Olin H. Landreth, Nashville; J. Foster Crowell and Henry G. Prout, New York; secretary, Francis Collingwood, New York; treasurer, John Bogart, New York. The next convention will be held in Chicago, from July 31 to August 5, 1893.

THE INCANDESCENT LAMP SITUATION.

OUTSIDE COMPANIES ARE BEING CLOSED UP SLOWLY, BUT SURELY—LAMPS MADE UNDER NON-INFRINGING PATENTS WILL BE BROUGHT OUT, IT IS SAID—GENERAL AND REMINISCENT NOTES.

It is reported on good authority that the new Westinghouse lamp is an undoubted success. An electrical engineer who visited the Pittsburgh factories of the Westinghouse Company in August last saw the new lamps burning at that time, and they have been in constant operation ever since.

The Chicago Edison Company, on January 14, obtained from the courts a restraining order against the Sunbeam Incandescent Lamp Company and the Illinois Lamp Company. The Sunbeam Company, it is reported, will have a new non-infringing lamp on the market within 30 days.

The Beacon Vacuum Pump and Electrical Company were granted an extension to prepare further evidence by Judge Colt, in the United States Circuit Court at Boston, on January 16, in the suit brought against them by the representatives of the General Electric Company. A final hearing in the case will be had on January 30.

A Chicago dispatch, which appeared in the *Boston News Bureau* for January 19, is as follows:

"The Edison Company is refusing to sell lamps to consumers with other plants than theirs, forcing promises to take out other plants and substitute theirs. A new lamp was offered here yesterday called the Shaefer incandescent. It is said to be no infringement. The Edison Company has begun serving notice on consumers that they will be held responsible for all infringement of the Edison lamp. It is estimated that $25,000,000 capital and 6,500 employés have been made idle by the recent decision. The Edison patent has two years longer to run."

Manchester was lighted again last night, the Mather Electric Company securing permission to use the Perkins lamps for the present. This permission was given in a telegram sent to the Mather people from the Edison company, in answer to the former's order for 700 lamps at once.—*Bridgeport, Conn., Standard, Jan.* 14.

Considerable discussion has been carried on of late relative to the new Westinghouse lamp. As we have before stated, we believe that the General Electric people mean to proceed against the new lamp immediately upon its appearance, on the ground that it is an infringement of the Edison patents. That is all right; if the General Electric lawyers really believe they have a case, the only place to settle it is in the courts. The Westinghouse lawyers, on the contrary, are equally certain that the new lamp is not an infringement, and as far as we are able to judge, the Westinghouse people seem to have the stronger case.

A carbon cannot be patented, neither can a vacuum; both were known to the ancients. It is the combination, however, which, has been patented by Edison. But the Westinghouse lamp does not include this combination; it does not require a vacuum, and, hence, it is claimed that it is no infringement on the Edison patents. But this is a point for the courts to decide.

The most foolish talk about Westinghouse, however, is that frequently heard to the effect that the company has no new lamp, and its pretending to have one is all a piece of deceit. If these good people will be patient, they will discover that the company actually has a new lamp. If they had only read the circulars which the Westinghouse Company has sent out to its customers regarding this lamp they would know that it would not dare to make such bold pretensions to something it did not possess.—*Boston Commercial Bulletin.*

As the court has refused to say what shall be considered a fair profit, and has refused to entertain the charge that the General Electric Company is a trust and designed to fetter competition, and, therefore, illegal and not entitled to relief by injunction, the controversy will be opened afresh in another court. The decision cuts both ways. The court says to the Westinghouse interests, "You must stop making such lamps." To the General Electric Company, "You must sell lamps at a reasonable price to those who began using them before the date of the decision, but we cannot tell you how much profit you can expect; that must be done in another forum."

It looks as if the patent would expire before the row is settled.—ELECTRICAL REVIEW, December 24, 1892.

The Edison patent will, presumably, expire on the date of the expiration of the Canadian 15 year patent, which is November 17, 1894. This gives the Edison patent about 20 months to run. The English patent, which expires November, 1893, was taken out subsequent to the American patent, and consequently does not affect it.

Much speculation has been indulged in as to how the lamp question would affect the World's Fair lighting, the contract for which was given to Westinghouse. The new lamp, is is safe to say, will be used at the Exposition, and as the bid for lamps was made on the basis of the former cost, the successful bidders will, by means of the cheapening of manufacture as announced, save a snug sum. The number of lamps contracted for was about 90,000, but the demand from exhibitors for special lighting, in addition, is said to be beyond all expectations, and this will vastly increase the amount of business secured by the World's Fair lighting contract.

The Naval Search-Light.

(From the Morning Advertiser, N. Y.)

Electricity has added an almost incredible percentage to the efficiency of our naval establishment, and the rapidity with which it has been adapted to purposes of warfare, and the completeness of the revolution it seems to be making in methods, are fairly marvelous. The search-light alone almost doubles the capacity of the ordinary ship of war.

When the British bombarded Alexandria, the search-lights on the vessels composing the squadron served not only to make the harbor as light as day on the darkest night, but enabled the admiral to observe the operations of the enemy on shore in the construction of batteries and earthworks, thus placing the Egyptians at a decided disadvantage.

It will enable a vessel to engage the enemy at night to almost as good advantage as during the day. It is useful in chasing a flying enemy and in conducting the management of a fleet. The assistance it gives in reconnoitering a coast will be readily appreciated. Difficult movements, such as entering a tortuous channel by night, passing between the vessels in a crowded harbor, and making a landing when the saving of time is of supreme importance, are all rendered comparatively easy by the search-light.

The search-lights of the British squadron at Gibraltar were the means of saving hundreds of lives when a merchant steamer sank in that harbor a few months ago. An effective search-light will make it almost as difficult for a torpedo boat to reach a warship by night as it is by day. Indeed, so difficult does it render the attempt that it has now been decided that the torpedo vessel and everything belonging to it, even to the faces of the men, must be painted black to avoid discovery.

LITERARY.

T. R. Sullivan (author of "Day and Night Stories") contributes to the February *Scribner* a sketch full of sentiment, entitled "To Her." A new volume of short stories by Mr. Sullivan will be published in the spring.

MEDICAL ELECTRICITY.

EDITED BY DR. J. MOUNT BLEYER, NEW YORK.

Discussion on "The Relative Fœticidal Value of the Galvanic and Faradic Currents in Ectopic Gestation."

The participants in the discussion were requested to emphasize the following points:

1. How does electricity destroy the life of the fœtus?
2. Which current should theoretically be more certain in its results? and what is the individual experience?
3. Can electricity be depended upon to accomplish the desired end? and why?
4. Should the galvanic current be used, interrupted or constant?
5. What is the best method of applying the agent?
6. What are its dangers? and how are they to be avoided?
7. Who should apply it? Can it be safely entrusted to the general practitioner?

Dr. Rockwell, of New York, said that in executions by electricity there was sometimes rupture of the blood vessels in the heart, owing to the tremendous force with which this organ contracts under such circumstances. Both from a theoretical and practical standpoint he preferred the galvanic current, and had used it in 23 cases of extra-uterine pregnancy. Where the faradic current is employed, it is often necessary to repeat the applications a number of times, and its use is more distressing to the patient. The extreme simplicity of the method is one of its great recommendations, and on account of this facility of application, it can be, and should be attempted by the general practitioner.

Dr. Malcolm McClean, of New York, was of the opinion that the life of the fœtus was destroyed by the action of the current on the extremities of the chorion villi. He preferred the galvanic current, as purely mechanical influence was not what was most desired here. Electricity could most assuredly be depended upon for this purpose, if used at the proper time, and in the proper manner. In applying it, he used an electrode placed on the abdomen over the locality of the ovum, and a vaginal one, consisting of a brass ball enclosed in a wet chamois bag. This electrode is placed well up in the vagina behind the uterus. One thorough application should be sufficient, but as a matter of precaution, he had employed it more than once. The method seemed devoid of danger, and any practitioner who can place an electrode in its proper place, and can make the diagnosis, is fitted to treat extra-uterine pregnancy by electricity.

Dr. Goelet considered that the death of the fœtus was the result partly of muscular contraction, and interference with the circulation of the chorion, and partly from paralysis of the heart muscle. This explanation seemed probable on account of the effect which the contractions of the uterus at times have upon the fœtal heart. He favored the employment of the interrupted galvanic current, and in the two cases in which he had used it, the results had been satisfactory. The method is thoroughly reliable. In order to properly concentrate the current on the fœtus, one pole should be placed in the vagina against the fœtal mass, and the other passed into the rectum beyond this point. The dangers of this treatment are more fancied than real; rupture is, of course, possible, but so far, no such accident has occured in the numerous cases reported. While the general practitioner may be qualified to carry out the necessary manipulations, he is disqualified for such work by reason of the rarity of these cases, and his consequent lack of experience, and should not, therefore, attempt their treatment, except when remote from large medical centers.

Dr. A. Brothers, of New York, said that the experiments of Dr. Lenz on small animals years ago, and more recently the experiments of Martin on incubating eggs, proved that the death of the fœtus resulted from the action of the current on the chorionic villi. The galvanic current is probably the most effective, but his own case had been successfully treated with the faradic current, and in a series of 43 cases which he collected some time ago, 21 had been treated by this current, 16 by the galvanic, two by both currents, one by static electricity, and in one the method was not stated. The electrical treatment is reliable, but the current should be strong, and, if possible, the patient should be anæsthetized. The faradic current should be employed a number of times. The interrupted galvanic current is theoretically the best form. The application is made by means of a large flat sponge on the abdomen and the ordinary vaginal electrode. The method is free from danger, if done in the early weeks and before symptoms of rupture. The fact that he was himself a general practitioner was a sufficient answer to the last question.

Dr. A. F. Currier said that there were undoubtedly cases in which the use of a galvanic current is indicated during the first few weeks, but its advantages under such circumstances are doubtful, for even if the subsequent history of the case be entirely favorable, one cannot be sure that the condition was really one of ectopic pregnancy. He felt that it would be exposing the patient to unnecessary danger to use an agent like electricity which, at the best, is uncertain, both in its immediate consequences and its ultimate results.

Dr. Gunning described some experiments which he had made on rabbits, indicating that the continuous current was safer, as it produces a vermicular action on the tube, and tended to favor the passage of the ovum along the tube. There are many more deaths, he said, following the use of the knife, than after electrical treatment, and when used in the early stages of pregnancy, it is one of the most serviceable and least dangerous agents at our disposal.

The president said that Dr. Gunning's experiments were an exemplification of the electro-physiological law concerning the contraction of muscle. A continuous current cannot produce a contraction of muscle by means of its nerve, but must be applied directly to the muscle, and if this be of the unstripped variety the contraction will set up a vermicular action.

Mr. Carty then referred to the probable actions of the different currents in the human body, as viewed from the standpoint of the physicist.

Dr. Brothers said that one of the chief objections to the electrical treatment of ectopic gestation, in the mind of Dr. Currier, seemed to be founded on the assumption that something dangerous was left behind, but the speaker had taken pains to communicate with those who had reported such cases, and received answers in regard to 25 of the cases. These responses were to the effect that in a very large number of the cases so treated, there were scarcely any traces of the original trouble after periods, varying from two to ten years, and in none of them was a secondary laparotomy required for the removal of any such remaining mass.

Regarding the dosage, Dr. Goelet thought 50 milliamperes would be sufficient for the constant current if concentrated upon the mass, and 20 for the interrupted; the faradic current should be used as strong as it could be borne.

Dr. Hahn was inclined to doubt the efficiency of such a mild current, as in a case in which he had made a negative intra-uterine application with a current of 40 milliamperes in a woman who was not known at the time to be pregnant, the pregnancy continued until the seventh month, and a living child was born.

Dr. von Raitz also reported two or three similar cases bearing upon this point, and tending to show that quite strong currents might be applied to the interior of the uterus, and yet pregnancy continue for some time afterward.

Dr. Rockwell, in closing the discussion, said that he hoped that all would agree that the galvanic current was the best form to use. Before the general introduction of the milliamperemeter, he had employed with good results an interrupted galvanic current from 15 to 20 cells.

"The Treatment of Salpingitis by Depletion and Drainage, Secured by Electricity," by Dr. Augustin H. Goelet, of New York.

The author stated that he had recently reported to the Obstetrical Society, a number of cases treated by this method, but some of the members were inclined to doubt the part played by the electricity in producing the good results, and objections were made to electro-therapeutics in general, on the ground that it was made unnecessarily mysterious and complicated. They endeavored to explain the results by supposing that they were due to rest in bed and the time consumed in the treatment. In reply to such criticisms, the author said, that the patients were not confined to bed at all, and the treatment was only adopted after protracted efforts by other methods, at the hands of other specialists, and after laparotomy had been advised. If those who thought the subject mysterious would take the trouble to study and understand it, the mysticism would disappear. The principles involved in the electrical treatment were depletion and drainage, with perhaps, stimulation of the lymphatics to promote absorption. The usually accepted methods of treatment he had found very slow and unsatisfactory, while electricity was not only more rapid, but often saved the patient from a mutilating operation. The essentials for success were an accurate diagnosis of the indications for treatment, and the adaptation of the electrical treatment to meet these indications. Bland Sutton says that the uterine end of the tube is rarely occluded in salpingitis, hence drainage in this direction is possible. Intra-uterine applications affect a cure of the endometritis, which is usually the cause of the tubal affection, and which is directly responsible for its continuance. The faradic current is employed to relieve the pain and to remove the capillary engorgement.

Dr. von Raitz had treated five or six cases of salpingitis by a stronger current of electricity preceding the application by the use of the uterine dilator.

Dr. Goelet, in closing, said he could see no necessity for preceding the application by the use of the dilator, since the negative pole produced sufficient relaxation and dilatation of the canal.

"The Negative Pole of the Galvanic Current an Aid to Uterine Development, with Cases," by Dr. Charles G. Canady, of Roanoke, Va.

Dr. Canaday said that in this country, the brain and nervous system are usually developed at the expense of other organs, and hence imperfect development of the uterus was exceedingly common. He cited a case where the treatment advocated in the paper resulted after five months in a decided development of the uterus, and a cessation of the epileptic attacks from which the patient had suffered.

Dr. von Raitz cited a case of imperfect development of the uterus which had come to him on account of sterility. In addition to treatment directed toward improving her surroundings, a strong faradic current was employed. After about four months, conception occurred, but she aborted in a few weeks. The treatment was resumed, and at present she is in the third month of pregnancy.

Dr. Mosher, of Brooklyn, said that the infantile uterus was undoubtedly more common than is generally supposed, and that this was due to lack of attention to the physical development of the growing child. While admitting the power of electricity to develop the uterus, she wished to place herself on record as most emphatically opposed to local treatment in these young girls, especially as it was in our power to accomplish the same purpose by attention to proper physical training of these individuals.

Dr. Goelet coincided in the views expressed by the last speaker, and added that where it was thought best to employ galvanic treatment in conjunction with the other measures, it could be done by making external applications, the negative pole being placed low down on the spine, and the positive pole at the nape of the neck.

Dr. Hall Brown, of Brooklyn, also wished to place herself on record as objecting to local treatment except where there is some specially serious condition present.

Dr. Canaday, in closing, said that he thought all the profession were agreed concerning the inadvisability of local treatment in young single women, but the case of epilepsy seemed to him sufficiently serious to warrant such interference.

By invitation of the resident members of the Electro-Therapeutical Association, the members, their ladies, and invited guests, were entertained with a private lecture and exhibition of the phonograph and micro-phonograph.

The lecturer, Dr. J. Mount Bleyer, described the circumstances leading to the invention of the phonograph, and the general principles of its action. He then took up the micro-phonograph, and showed in what respects it differed from the ordinary phonograph. Lieutenant G. Bettini, the inventor of the micro-phonograph, found that the diaphragm instead of vibrating as a whole, vibrated in numerous small divisions or sectors, which may happen to be in tensioned sympathy with the vibrating organs of the voice, or of other tones directed against the diaphragm. In order better to utilize these vibrations, instead of having the central needle-point connected rigidly with the diaphragm, he attached it by means of a number of radial bearings of unequal length, so that should the center of the diaphragm, for example, happen to be a node or a silent point not in sympathy with a certain pitch or tone, some small sector might prove to be in exact sympathy, and would thus cause the needle through one of these bearings, or "spider legs" to respond, and in this way, the whole diaphragm would not only be utilized, and the tones made many times louder than by a single point, but the instrument would be capable of reproducing a much greater variety of *timbre* of the voice, and a much greater number of voices and sounds than it would be possible to do with the ordinary phonograph. This principle which the inventor worked mechanically, was also developed about the same time theoretically by Dr. Wilford Hall, and described by him in an editorial in "The Microcosm," vol. ix, February, 1892. A more remarkable case of determining intricate mechanical and scientific results by pure philosophical reasoning, it would be hard to find. Dr. Hall denies that a sounding instrument sends off any *air* waves at all, and claims that *sound* waves radiate from a sounding body. This sound force is assumed only to act sympathetically on a body in unison with its vibrational number, and it is a fact that a tensioned diaphragm is really composed of many sections of tensional sympathy, each one of which is actuated by a tone of corresponding pitch or synchronism. It is evident from this that such sectional vibrations of a diaphragm of a phonograph at all sides of the needle, according as the pitch and intensity of the tone change, must give a slight lateral movement to the needle point in its line of indentations on the cylinder, as well as the appropriate varying degree of depth and distance apart of the individual impressions. This, then, is the secret of the wonderful powers of the phonograph.

Dr. Bleyer then described the various applications of the phonograph, particularly in medicine. At the close of the lecture, Lieutenant Bettini gave an exceedingly entertaining and successful demonstration of the remarkable powers of his micro-phonograph.

[THE END.]

Electricity in the Skin—Proper Insulation May Prove of Value.

It seems that the Russian scientists are trying to rival all others. They are pushing fast of late in many branches. Electricity has captured their fancy. Professor Tarchanoff, of St. Petersburg, has shown in his last published work, the results of his researches with the electric currents of the skin. His method is good, as it is peculiar and new. The experiments led him to connect the skin of various parts of the body, by means of non-polarizable clay electrodes, with Meissner's galvanometer. He noticed then the various stimuli of the skin, such as light tickling with a brush, heat, cold, a needle prick, sound, light, taste and smell. In all these cases, a strong deflection of the galvanometer needle was observed. Merely opening the eyes, after they had been closed for some time, produced a considerable deflection; and mental efforts, like calculation, also had a similar effect.

If our Russian brother has discovered the fact that the human skin gives off constant currents of electricity, why then will it not follow that these currents could thus be impeded by a proper application of insulating non-conductors, and thus much of the health of beings maintained and their life prolonged many years? We could by such an insulation of the body use, over and over again, the expelled electric currents, and shall thereby obviate the necessity of drawing upon the organism for a new supply.

I suppose that these currents if they exist, as told to us by the learned scientist, under the influence of ordinary clothing must pass off with the moistened deposits which are being constantly expelled and a new supply of electricity would have to be found somewhere. Such electricity having its source perhaps in the decomposition of metals, taken in the food we eat and the air we breathe, must of necessity entail upon the organism a continuous strain in its production; it may be that from such causes that the body becomes fatigued after a few hours of exertion, and absolute rest becomes necessary for recuperation.

Should these experiments prove true, there is no doubt that, by the proper insulation of the human body, much therapeutical value would be its outcome. BLEYER.

ANEURISM TREATED BY ELECTRICITY.

In Cincinnati one of our eminent American surgeons, Dr. Connor, has tried electricity in the treatment of aneurism. He proposed to treat by puncturing the aneurismal sack by needle or otherwise, and thus produce closure of the artery by a formation of a clot. We hope that he has succeeded, as it would add another great achievement to the history of American surgery.

THE GALVANIC CURRENT AS A MEDIUM FOR THE EXAMINATION OF THE URINE, SPECTRUM, ETC.

The Viennese medics have again distinguished themselves by bringing before the notice of the medical world the application of the current as a medium for the examination of urine, spectrum, etc., instead of the *centrifuges* now so much in use for producing deposition. The method is based on the same principle as that devised by Webster for the electrical treatment of sewage, spoken off in these columns at length. By the electrolytic action of weak galvanic currents, the gas bubbles formed in the liquid carry with them the formed elements—cells, bacteria, even crystals—to the surface, whence they may be easily removed for microscopic examination, etc.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

PHILADELPHIA, PA.—Two more of the street railway companies, the People's and the Hestonville, are discussing the advisability of introducing the trolley on all their lines.

CLINTON, MASS.—E. C. Swift, the Chicago beef man, has offered to build an electric railway from Clinton to Lancaster, and as soon as he files a formal petition a franchise will be granted.

CHICAGO, ILL.—The Englewood and Chicago Electric Street Railway Company, capital, $1,000,000, has been incorporated to build a railway through the streets of Chicago to the boundary line between Illinois and Indiana. The incorporators are James P. Mallette, D. D. Chidester and William H. Comstock.

NORRISTOWN, PA.—James W. Shepp, of Philadelphia, and Joseph Fornanue, of Norristown, representing the Norristown and Conshohocken Passenger Railway Company, have asked the Conshohocken town council for a franchise to construct an overhead trolley electric railway.

BRATTLEBORO, VT.—The stockholders of the proposed electric railroad have organized by electing E. W. Stoddard president, and E. L. Waterman clerk.

NIAGARA FALLS, N. Y.—The Lewiston and Youngstown Electric Railroad Company has filed with the county clerk a map of its proposed route from Lewiston to Youngstown. The road will be completed in time for next summer's travel.

ROCKVILLE, CONN.—The preliminary survey for the proposed electric road from Rockville to Ellington is about completed, and work will begin in the spring.

SAVANNAH, GA.—The People's Electric Light and Power Company has purchased the entire stock of the Savannah Electric Company amounting to $125,000. The company gets control of ten miles of road now in operation and of three miles of railway in course of construction. About $200,000 will be expended for a lighting plant, in addition to the power plant, new cars, etc.

STEELTON, PA.—The Middletown, Highspire and Steelton Electric Railway Company has been incorporated by George W. Cumbler, James Young, J. E. Rutherford and John Q. Denny.

COLUMBUS, O.—Mr. Dodge will introduce an amendment to the Hocking Canal Abandonment bill. He will advocate the building of a State electric railway on the canal tow, to be operated by the Board of Public Works.

GRAFTON, MASS.—The Grafton Street Railway Company; capital, $6,000. The road will be 12 miles long, and will run from Wilkinsville to Fisherville, Farnumsville and Grafton.

BRIGANTINE BEACH, N. J.—The Brigantine Transit Company; capital, $250,000. Incorporators, Charles Evans, Albert M. Jordon, Joseph Thompson and Clarence L. Cole, of Atlantic City.

ORANGE, N. J.—The Orange Valley Street Railway Company; capital, $10,000. Incorporators, Stephen D. Day, Frank W. Child, James S. Holmes and Chas. A. Lindsley.

BROOKLYN, N. Y.—The Brooklyn Traction Company has been incorporated with a capital of $10,000, for the purpose of constructing street railways and equipping them with electrical and other power. The directors are E. D. Phillips, Albert Strauss and E. J. Kavanaugh, of New York city, and P. J. Vaughn and J. Lockman, of Brooklyn.

ASBURY PARK, N. J.—The Asbury Park and Belmar Street Railway Company; capital, $75,000.

DUBUQUE, IA.—The United States court has ordered the receiver to sell the entire plant of the Allen & Swiney Electric Railway Company during the first week of March.

SEATTLE, WASH.—Guy C. Phinney has filed a petition for privilege to build a system of electric street railway from Pioneer Place to Woodland Park.

CARTHAGE, MO.—The Carterville and Webb City Electric Railway Company; capital, $100,000. Incorporators, C. A. Parker, L. P. Marx and S. F. Rowe.

BUFFALO, N. Y.—The Buffalo and Tonawanda Electric Railway Company, capital, $100,000, has been incorporated by Frederick Swift, L. P. Iney and W. Goodwin, of New York, and G. H. Wirth, of Brooklyn.

AKRON, O.—An electric street railroad between Akron and Silver Lake is now assured.

WOODBURY, N. J.—The Woodbury Electric Railroad and Power Company; capital, $150,000. W. Harrison Levermore, president; H. H. Clark, secretary; W. McGeorge, treasurer. The company will build an electric line from Woodbury through Gloucester to Camden.

LANCASTER, PA.—The Lancaster and Manheim Railway Company has been incorporated with a capital of $250,000. John A. Coyle is president.

NORRISTOWN, PA.—Cornelius F. Gallagher, of New York, has purchased 502 shares of the Norristown Passenger Railway Company. This means another trolley line for Norristown.

KANKAKEE, ILL.—The North Kankakee Electric Light and Railway Company has increased its capital to $100,000.

WORCESTER, MASS.—Arrangements are now under way which, when carried out, will make Worcester the center of the largest single suburban system of electric roads in this country. The new road will be known as the Central Massachusetts Street Railway Company, which will petition for franchises for about 44 miles of new electric lines in two cities and 12 towns, to be operated in connection with the Worcester, Leicester and Spencer, the Worcester and Millbury and the Worcester and Southbridge electric street railway lines. To carry out the proposed scheme will cost between $800,000 and $1,000,000.

PUEBLO, COLO.—The Pueblo City Railway Company has elected J. E. Downey, president; A. W. Chamberlain, vice-president; G. H. Hard, treasurer; Julian B. Downey, secretary; H. E. Chubbuck, general manager, and W. A. Martin, superintendent for 1893.

SCRANTON, PA.—The Scranton and Pittston Passenger Railway Company; length, 15 miles. Incorporated with a capital of $90,000. Louis A. Waters, president.

LANCASTER, PA.—The Lancaster and Terre Hill Street Railway Company. Incorporated by Jno. D. Skeles, as president, with a capital of $200,000.

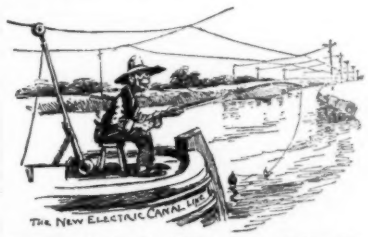
PHILADELPHIA, PA.—The Jenkintown Electric Railway Company; capital, $150,000. Incorporators, William Wharton, Jr., John W. Henderson, William S. Watson and Joseph W. Tilton.—The Fifth and Sixth Streets Passenger Railway Company has applied to the city councils for the privilege of constructing a trolley line from Frankford to Kensington avenue and Fairmount Park.

DETROIT, MICH.—John W. Sincock and Chas. Wright, of this city, have been granted a franchise to build a street railway at Highland Park, Mich. The motive power is to be electricity or cable.

SCRANTON, PA.—The Lackawanna Street Railway Company has been incorporated with a capital of $60,000, for the purpose of building a street railway from Scranton to Old Forge, ten miles.

WILMINGTON, DEL.—A company has petitioned the legislature for a charter to build an electric railway between Wilmington and Brandywine Springs.

PEEKSKILL, N. Y.—The Peekskill Surface Railroad Company has applied for a franchise to construct an electric railway in the streets of this city. Among the incorporators are Clark D. Rhinehart, James M. Grifford and E. H. Hobbs, of Brooklyn; Jesse Stearns, of New York; Wm. Lawson, D. S. Monsarat and E. D. M. Lyons, of Peekskill. The capital is $50,000.



NEIGHBOR (on bank)—"What are you fishing for, Pat?"
PAT—"It'll be fur electric eels!"—*Once a Week.*

WASHINGTON, D. C.—A bill to incorporate the Chesapeake and Washington Underground Electric Railway has been introduced in the Senate. The incorporators are Henry Carey, of New York; John D. Parsons, of Virginia; J. W. Parsons and W. Wheeler, of the District of Columbia.

Electric Light and Power.

HOT SPRINGS, ARK.—The electric light company will increase its present plant to 500 horse-power.

CLOQUET, MINN.—The Cloquet Electric Light and Power Company, capital, $50,000, has been incorporated.

NEW HAVEN, CONN.—The New Haven Electric Company has increased its capital from $300,000 to $400,000. The increase has been paid in cash.

FRANKLINVILLE, N. Y.—An electric light plant is to be erected at Franklinville.

CHICAGO, ILL.—The Chicago-Topeka Light, Heat and Power Company; capital, $1,200,000. Incorporators, William Brace, John Campbell and Cornelius V. Smith.

CHICAGO, ILL.—The Hammond Light and Power Company; capital, $10,000. Incorporators, M. M. Towle, Frank J. Baker and Alonzo Stephens.

MOUNT CARMEL, ILL.—The Mount Carmel Light and Water Company; capital, $50,000. Incorporators, W. S. Reed and Joseph H. Reynolds.

DULUTH, MINN.—The Commercial Light and Power Company; capital, $500,000. Incorporators, G. A. Leland and Franklin Paine, of Duluth, and Morgan Brooks, of St. Paul.

MARTINSBURG, W. VA.—An electric light plant will be erected by the Martinsburg Electric Light and Power Company.

GIRARDVILLE, PA.—The Girardville Electric Company has organized by electing Albert Bordy, president; Moses Mervine, treasurer, and Wm. J. Yeo, secretary.

New Manufacturing Companies.

CHICAGO, ILL.—The Automatic Telephone and Electric Company, of Illinois; capital, $250,000. Incorporators, J. R. Griffiths, Victor C. Sanborn and S. Coolidge.

CHICAGO, ILL.—The Northwestern Telephone Company; capital, $10,000. Incorporators, Joseph H. Whitfield and John Z. Westervelt.

UXBRIDGE, MASS.—C. D. Morse, of Millbury, states that a plant for the manufacture of electric cars will be established here at once. A company with a capital of over $100,000 will be formed.

WINCHESTER, KY.—The McNeill-Tinder Electric Company, capital, $100,000, paid up, $60,000, has been incorporated to erect electrical works and manufacture the "M. & T." lamp hour recorder. S. P. Kerr, president; C. F. Klein, vice-president; T. Landsberg, treasurer; J. H. Tinder, secretary, and Wm. McNeill, electrician.

NEW YORK CITY.—The Columbian Emery Wheel Company, with $6,000,000 capital, was organized under the laws of the State of New Jersey, at Trenton, on Thursday, January 12, 1893. The following were made directors: Frederick S. Dickson, Philadelphia, Pa.; F. H. Pietsch, Chicago, Ill.; L. Best, New York, N. Y.; C. Ross Grubb, Camden, N. J.; Clarence Tebbetts, Waltham, Mass.; F. R. Preston, Detroit, Mich.; Harlan Page, Philadelphia, Pa.; Geo. Maitland, Detroit, Mich.; Geo. W. Jackman, Bridgeport, Conn. The following officers were elected: Frederick S. Dickson, president; F. H. Pietsch, vice-president; L. Best, secretary; F. R. Preston, treasurer. The Columbian Emery Wheel Company has for its purpose the purchase of all of the emery mills and the emery and corundum wheel factories in the country. The headquarters of this company will be in New York city. Its stock will soon be on the market for sale; preferred stock will pay eight per cent. dividends. It is expected that this company will have annual sales approximating $2,000,000.

SALEM, MASS.—The Ober Electric Brake Company has been organized with H. B. Walmsley, of Lynn, president; Wm. Stopford, of Beverly, secretary-treasurer; W. K. Bigelow, of Salem, W. Y. Ober and F. S. Alley, of Lynn, C. P. Kerrans, of Danversport, and Zina Goodell, of Salem, directors.

SPRINGFIELD, ILL.—The Illinois Electrical Forging Company; capital, $2,000,000. The object of the company is the heating and forging of metals in all forms, the smelting of ores, the heating of buildings and the cooking of food by the use of electric heat.

Increase of Capital Stock.

BRIDGEPORT, CONN.—The Bridgeport Electric Light Company has filed a paper at the Secretary of State's office, recording a vote to increase the capital stock of the company from $200,000 to $300,000.

NEW YORK CITY.—The stockholders of the Central and South American Telegraph Company met last week and ratified the increase of capital stock of the company from $6,500,000 to $8,000,000. This increase was authorized some months ago to provide for the duplication of the company's cable on the west coast of Central and South America.

Force of Habit.

"Emma," said her mamma, rushing from the library into her daughter's boudoir, "Cholly wants to talk to you at the telephone."

"Horrors!" exclaimed the dear girl. "And I look like a fright in this old wrapper."—*Chicago News.*

KINDRED INTERESTS

We are Hearing a good deal about sal-ammoniac as we journey about. The latest is the announcement of the A. B. C. Company, which appears on another page. These energetic people make an announcement that is well worth considering by prospective purchasers of goods of this description.

"The Span of Life" is the name of a new play which was put on at the People's Theatre on the Bowery, on Monday, January 16. The weary electrical worker can spend an evening viewing it and be considerably entertained and amused. A novel feature is a bridge of human bodies, a thrilling act performed by a troupe of athletes.

Bartlett & Company, engravers, designers and printers, 21 Rose street, New York, are doing some remarkably artistic catalogue work for the electrical and allied interests. Recent work in this line for the Stanley Electric Manufacturing Company and the Ball & Wood Company surpasses anything we have yet seen in the way of catalogues.

The Construction Department of the Ries Electric Specialty Company, Baltimore, Md., is kept very busy installing isolated plants in connection with the Ries regulating socket. In fact, when a would-be purchaser is told the conveniences, as to regulation of the light, etc., that can be given him now, this company has no trouble in securing the contract.

The Lundell Motors, made up to five horse power, which have recently been put upon the market by the Interior Conduit and Insulation Company, of New York, and are being introduced in the West by the Central Electric Company, of Chicago, are meeting with a ready sale, and the Central have already installed several of them in their territory. They have issued a complete descriptive circular and will be pleased to furnish the same to any one desiring information bearing on the above.

Queen & Company, Incorporated, Philadelphia, have sold nearly all the Ayrton & Perry ammeters and voltmeters which they advertised so extensively at reduced prices, but a few still remain, which are offered at a mere fraction of the original manufacturing cost; for instance, an ammeter with capacity of 400 amperes being placed at $16. Any one who wants a portable instrument for general testing, where great accuracy is not required, will find it very advantageous to purchase now, before the stock is entirely exhausted. Descriptive circular No. 355 will be mailed by the makers upon application.

Mr. Fremont Wilson.

Mr. Fremont Wilson has established himself at Room 159, Times Building, New York city, as an appraiser of fire losses on all kinds of electrical apparatus and machinery. He does not take contracts or enter into contract work, except as a consulting expert, and he is neither agent for nor connected with any electric light corporation or contracting firm. His services will be found to be of special value to electric lighting companies, contractors, architects, and all who are in need of an expert's opinion in the installation of any electrical work.

Mr. Wilson has had more than ten years' experience in the electrical business, having been connected with the Western Union Telegraph Company and the Edison Company for five years. He was Mr. Frank J. Sprague's principal assistant for a long time, and installed the steam and electric plant for the Julien Traction Company, of this city. Mr. Wilson then became a contractor for interior electric lighting work, but gave up this business to become an insurance expert for electric lighting companies. He has special methods of his own for interior wiring, which are now being adopted for the interior incandescent wiring at the World's Fair. He is also thoroughly familiar with alternating current installations. Mr. Wilson stands well with the leading boards of fire underwriters, and is authorized to make surveys subject to their authority throughout the country.

The Hello Girl.

If the new invention to dispense with the telephone girl comes into general use, it will be regretted by many. It will be regretted by the profane man who is in the habit of unburdening his heart over the wire; it will be regretted by the chronic "kicker," who cannot pour into a sympathetic ear his grievances. That his "battery is low, in consequence of which his bells don't ring, and that the telephone is all worn out, anyway, and he ought to have a new one put in"; it will be regretted by the bright young man who thinks that his whispered "Ah, there" fills the heart of the dainty creature at the end of the line with ineffable delight; it will be regretted by the verbose man, who calls up and asks, "Is this the office of the Central Pennsylvania Telephone and Supply Company, Williamsport, Lycoming County, Pa?" "Yes." "Is the manager there?" "No." "Ah, yes, don't know when he will be in? Yes, well, I think I will tell you what I want; I would like to talk to Lock Haven, I came away this morning not intending to ——" "Here's Lock Haven." "Ah, yes, well, thank you. I came away, etc." By some it will be hailed with delight. By the suspicious man who imagines that the girl at the exchange, with some eight or nine demands per second upon her attention, is constantly eavesdropping and eager to learn the privacy of his conversation; it will be hailed with delight by the man who calls a mellifluous, "Hello, thro' with the line?" "chipping in." The telephone girl who has so well learned the lesson that it is the distinct, clear answer, not the soft answer, that turneth away wrath, will be no more. She will no longer offer the prayer, "Forgive us our debts as we forgive our deadbeads."—*Williamsport, Pa., Times.*

WORLD'S FAIR NEWS.

On account of the illness of Chief Allison, of the Manufactures Department, Director-General Davis assumed charge of the office this week, and decided to close up the business within the next few days. He called about him Chiefs Skiff, Buchanan and Smith and Assistant Chief Hornsby, of the Department of Electricity, and each was given one or two groups in which to make the assignments. The Director-General and the four chiefs, with Assistant Chief Williams, of the Manufactures Department, met Monday and the matter of pushing this work forward was begun in earnest, and it is expected that before the end of this week there will be no space left unassigned in the department.

The Bell Telephone Company has commenced the erection of its pavilion in the south end of the electrical building. So also has work begun on the pavilion of the Western Electric Company. The exhibits of both will be largely historical and will show models of the most crude electrical contrivances ever used, and other machines and appliances showing the successive steps in development up to the present day.

A bill for an injunction against the World's Columbian Exposition was filed in the Superior Court Monday, this week, by the Babcock & Wilcox Company, of New Jersey. The bill sets forth that the complainant, one of six firms of boiler makers known as the Temporary Association, received a contract for boilers from the World's Fair. The companies of the Temporary Association make boilers of a certain approved type, and the device of any one of the firms may be safely used in connection with the devices of all others. The six firms are the Abendroth & Root Manufacturing Company, of New York; the Campbell & Zell Company, of Baltimore; the Sterns Manufacturing Company, of Erie, Pa.; the National Boiler Company, of New Brunswick, N. J.; the Heine Safety Boiler Company, of St. Louis, and the complainant company, of New Jersey. The complainant, under the impression that only the six named companies were to construct boilers, having been awarded a contract, deposited a bond of $10,000 for the satisfactory performance of the work, and expended a large sum of money in pursuance of that contract. Now it is informed that the Sterling Boiler Company, maker of another type of boilers, is to be allowed space for boilers of that type, and the complainant company demurs against this action of the World's Fair on the ground that it increases the complainant's risk under its bond, and establishes a condition under which the Babcock Company would not, knowing it to exist, have offered to bid for the work. Therefore, the complainant prays that the defendant, the Columbian Exposition representatives, be enjoined from allowing the Sterling boilers to be put in.

Chicago, January 14.

WANTED TO BUY INCANDESCENT & ARC DYNAMOS, ENGINES, BOILERS, WIRE, Etc. Either new or in good condition

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Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 3.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

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2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

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